REPORTS, RETURNS, AND STATISTICS

OF THE

INLAND REVENUES

OF THE

DOMINION OF CANADA

FOR THE FISCAL YEAR ENDED MARCH 31

1917

PART III

ADULTERATION OF FOOD

PRINTED BY ORDER OF PARLIAMENT

OTTAWA
J. DE LABROQUERIE TACHÉ
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1917

No. 14—1917.]

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REPORT

OF THE

DEPUTY MINISTER OF INLAND REVENUE.

OTTAWA, July 1, 1917.

To the Honourable ALBERT SÉVIGNY,
Minister of Inland Revenue,
Ottawa, Ont.

HONOURABLE SIR,—I have the honour to herewith submit to you a report of the work performed by the Laboratory of the Inland Revenue Department during the fiscal year ending on the 31st of March, 1917.

This report is prefaced by a review from the Chief Analyst of the work performed by the Laboratory staff during the fiscal year. It is unnecessary, therefore, for me to go into the matter therein referred to.

The Laboratory of the Department of Inland Revenue is gradually assuming its proper place amongst the services instituted by the Government for the protection of the public. The establishment of three branches, at Halifax, Winnipeg, and Vancouver respectively, has already proven the importance of this development in both facilitating and expediting the work of the Department, which has shown in many instances to have been a very great advantage to the public in general, and to trade in particular.

The department has, at present, under consideration, the extension of its mailing list, so that a greater public good may be derived from the publication of the bulletins through a wider dissemination of information of great interest to the business world and to the consuming world.

In this year's report, the department has determined to eliminate from the bulletins reproduced herein, the list of samples which usually accompanies the bulletins. This was done for purposes of economy, as there is no practical advantage in reproducing these lists of samples, when they have already been published with the bulletins and widely circulated throughout the year.

In conclusion, I may say that we have tangible evidence that both the honest business man, who happily forms the vast majority of our trade, and the people, are appreciating more and more the excellent work performed by Dr. McGill and his assistants.

I have the honour to be, Honourable Sir,
Yours very truly,

J. U. VINCENT,
Deputy Minister of Inland Revenue.

REPORT OF THE CHIEF ANALYST.

OTTAWA, June 21, 1917.

J. U. VINCENT, Esq., K.C.,
Deputy Minister of Inland Revenue,
Ottawa, Ont.

DEAR SIR,—I beg to submit herewith a report of the work done in the laboratories of the Inland Revenue Department during the fiscal year ending 31st March, 1917.

In my report of last year I referred to the satisfactory working of the sub-laboratories at Halifax, Winnipeg and Vancouver. I am pleased to be able to state that another year's experience goes to justify the step taken in the establishment of these local branches of the main laboratory. They have been found to do good service in many ways, and especially in enabling local work to be performed with less delay than formerly. I expressed a hope that further extensions might be found feasible in the near future, and particularly in the larger manufacturing and commercial centres. Although the demands made upon the national revenues at the present time are such as, for the moment, to necessitate retrenchment wherever possible, I am convinced that one notable outcome of the present war will be the successful development of manufactures heretofore regarded as too well established in the older countries to make hopeful any considerable rivalry on the part of Canada. This will, of course, involve largely increased work for our laboratories, where foods, drugs, or fertilizers are concerned, as well as in cases where alcohol, either as such, or suitably denatured, is permitted to be used, duty free or under specially privileged condition.

Halifax sub-laboratory.—This has been in charge of Mr. C. C. Forward, with Mr. A. J. Landry as assistant.

The subjoined statement gives, in concise form, the work done during this year.

No. of Samples Received.	Number Reported.	Description.	Date of report to Chief Analyst.
4	23	Canned tomatoes, 1916	April 24 and May 20.
29	41	Temperance beer	" 24 " 20.
4	23	Bran	" 24 " 24.
8	8	Florida water, etc	" 24.
2	3	Gluten meal or flour	" 24.
2	5	Aspirin	" 24.
93	93	Fertilizers	May 22 and July 18.
40	40	Maple syrup	July 18.
33	33	Gelatine	" 24.
34	34	Feed flour	" 19.
60	60	Tea	Aug. 4.
30	30	Prepared mustard	July 22.
30	30	Vanilla extract	Aug. 12.
30	30	Malt vinegar	Oct. 11.
39	39	Canned peas	Sept. 25.
39	39	Baking powder	Oct. 17.
14	14	White lead paint, 1917	Jan. 6, 1917.
15	15	Packaged borax	" 6.
20	20	Caramels	" 6.
20	20	Headache powders	" 6.
20	20	Ketchup	" 6.
5	5	Cream of tartar	Mar. 31.
35	.....	Butter	
27	.....	Chop feed	
66	.....	Evaporated fruit	
60	.....	Black pepper	
8	.....	Peanut butter	
20	.....	Fertilizers	
787	625		
111	111	Malt liquors for export—Excise.	
37	37	Special samples as follows :—	
		19 alcohol tests in beer, etc.	
		10 fertilizer materials.	
		4 cream.	
		1 flour.	
		1 evaporated apples.	
		1 boiler feed water.	
		1 cream of tartar.	
935	773		

Total number of samples received	935
Number received before March 31, 1916, reported	54
Total number samples reported	773
Work in hand, March 31, 1917, not reported	196

Soda solution supplied to Collector I. R. St. John, N.B., 1 Winchester.
Fees collected for analysis of special samples above mentioned and sent to Department, $106.25.

Winnipeg sub-laboratory—Has been in charge of Mr. E. L. C. Foster during the ear, with Mr. W. A. Davidson as assistant.

Mr. Forster's report is as follows:—

anned tomatoes	30	Malt vinegar	20
emperance beers	19	Baking powders	50
ay rum	10	Borax	10
ertilizers	42	Marmalade	20
lorida waters	10	Ketchup	15
ran	20	Caramels	15
eed flour	18	White paint	8
luten flours	3	Headache powders	15
elatine	17	Black pepper	60
laple syrup	25	Chop feed	38
repared mustard	15	Evaporated fruits	52
ea	129	Butter	39
anilla extract	15		
anned peas	49	Inspectors' samples	744

and the following forty-seven occasional samples:—

Butter	12	Baking powder	1
Evaporated apples	20	Vanilla extract	1
Milk	2	Cream	4
Beer	3	Buttermilk	1
Cream of tartar	1		
Wine	2	Total	791

The following excise solutions were also furnished:—

Normal soda solution	34 winchesters.
Normal sulphuric acid	1 4-oz. bottle.
Phenolphthalein solution	5 bottles.

Vancouver sub-laboratory—Has been in charge of Mr. J. A. Dawson during the year, with Mr. P. T. Kirwan as assistant until 31st May, 1916, when he resigned. Mr. F. C. Collier was sent out as assistant, July 1, 1916. Mr. Dawson's report of work done is as follows:—

Date.	Collection.	P.T.K.	F.C.C.	J.A.D.	Total.
1916.					
April 21	Coffee			80	80
May 2	Cream of tartar sub's	3			3
" 9	Vinegar			22	22
" 18	Sugar	49			49
June 14	Fertilizers			35	35
July 17	Chocolate			32	32
" 22	Evaporated fruit		40		40
Aug. 14	Cassia and cinnamon			22	22
" 25	Maple syrup		27		27
Sept. 15	Tomatoes		29		29
" 22	Temperance beer			6	6
Oct. 5	Toilet lotions			10	10
" 10	Gluten flour		3		3
" 18	Feed flour		8		8
" 31	Vanilla extract			10	10
Nov. 3	Bran		24		24
" 13	Gelatine			12	12
" 25	Prepared mustard			10	10
" 23	Tea		20		20
Dec. 9	Malt vinegar			20	20
" 29	Marmalade		20		20
" 30	White lead			8	8
1917.					
Jan. 5	Borax		5		5
" 15	Catsup		10		10
" 20	Caramels			10	10
Feb. 14	Peanut butter		5		5
" 15	Headache powders			10	10
Mar. 3	Butter			30	30
" 13	Evaporated fruit			34	34
" 14	Chop feed		31		31
" 28	Black pepper		45		45
		52	267	351	670
	Special samples		14	4	58
		52	281	355	728

The following solutions were supplied: 3 winchesters of normal soda, one bottle $\underline{N}$ H_2SO_4, and one bottle phenolphthalein.

The special samples were evaporated apples (Customs) 45, evaporated vegetables 7, vinegar 3, honey 1, sugar 1, arsenic 1.

The personnel of the technical staff of these laboratories, including the sub-laboratories is as follows:—

Title.		31st March, 1916.	31st March, 1917.
At Ottawa.....	1 Chief Analyst.....	A. McGill.....	A. McGill.
	2 Deputy "	A. Lemoine.....	A. Lemoine.
	3 First Assistant.....	A. Valin.....	A. Valin.
	4 Second "	V. Kitto	V. Kitto.
	5 Third "	S. J. Cook	S. J. Cook.
	6 Fourth "	F. C. Collier.....	F. C. Collier (a).
	7 Fifth "	L. E. Westman.....	L. E. Westman (b).
	8 Sixth "	Vacant	G. H. Brother (c).
	9 Seventh "	"	M. Brot (d).
	10 Eighth "	"	R. M. Rowat (e).
	11 Ninth "	"	G. E. Grattan (f)
	12 Tenth "	"	J. A. Gunton (g).
	13 Eleventh "	"	W. H. Hill (h).
	14 Twelfth "	"	O. G. Lye (k).
	15 Laboratory Asst.....	Miss Wright.....	Miss Wright.
At Halifax...	16 In charge.....	C. C. Forward.....	C. C. Forward.
	17 Assistant..	A. J. Landry.....	A. J. Landry.
At Winnipeg.	18 In charge.....	E. L. C. Forster	E. L. C. Forster.
	19 Assistant	W. A. Davidson.....	W. A. Davidson.
At Vancouver	20 In charge.....	J. A. Dawson.....	J. A. Dawson.
	21 Assistant.....	P. T. Kirwan.....	F. C. Collier (a).

(a) Transferred to Vancouver, 30th June, 1916.
(b) Absent, on leave, at Columbia University, from 1st November, 1916.
(c) From 25th May to Sept. 14th, 1916. Absent, on leave, at Toronto University, from Sept. 14th.
(d) From 1st June, 1916, to Dec. 31st. Absent, on leave, for munition work in France from latter date.
(e) From 8th August, 1916.
(f) From 15th January, 1917.
(g) From 13th January, 1917.
(h) " "
(k) From 10th February, 1917.

It will thus be seen that the technical staff at the main laboratory at Ottawa comprised 5 analysts for the entire year; in addition to which we had:—

Mr. Rowat for 8 months.

Mr. Westman, Mr. Brot for 3 months, Mr. Collier, Mr. Brother for 3 months, Mr. Gratton, Mr. Gunton and Mr. Hill for 2½ months and Mr. Lye for 2 months.

Vacancies noted in my last report have now been filled and the Ottawa staff, as at present constituted, is very satisfactory.

In addition to the above, Mr. S. Mirsky has been employed since 8th January, 1917, as laboratory assistant.

The following work has been done during the fiscal year; results being published as usual, in the form of bulletins.

ANNUAL REPORT—FISCAL YEAR 1916-17.

Number of Bulletin.	Subject Bulletins issued.	Number of samples.	Number of Bulletin.	Subject Bulletins Issued.	Number of samples.
338	Sausages	141	354	Gluten flour	21
339	Sweet spirit of nitre	85	355	Bran	186
340	Ground coffee	407	356	Aspirin tablets	65
341	Household ammonia	162	357	Canned tomatoes	222
342	Liquid extract of nux vomica	19	358	Cassia	143
343	Sugar and icing sugar	251	359	Tea	250
344	Spirit of camphor	168	360	Baking powder	213
345	Evaporated milk	73	361	Prepared mustard	124
346	Chocolate candy	151	362	Gasolene	88
347	Fertilizers for 1916	365	363	Malt extract for bakers' use	152
348	Maple syrup	162	364	Malt vinegar	185
349	Mace	175	365	Caramels	110
350	Feed flour	170	366	Canned peas	210
351	Bay rum, Florida water, etc.	75	367	Gelatin	137
352	Evaporated fruits and vegetables	180	368	Ketchup	111
353	Temperance beer	129		Total number of samples	4,930

In addition to the above, the following occasional work has been done and reported to the department in the regular correspondence:—

Acetic acid	52	Flour	1
Acetophen	1	Formin tablets	1
Ale	5	Fusel oil	13
Ammonium nitrate	1	Grape dregs	1
Aspirin	1	Honey	3
Baking powder	1	Humus	1
Barley	1	Icing sugar	1
Basic slag	2	Insecto	1
Beer	48	Jam	34
Belladona	1	Katalys powder	1
Benzol	12	Lemon extract	3
Bordeaux mixture	1	Lime juice	2
Bran	1	Lin. saponis	1
Butter	30	Liquor	6
Butter substitutes	2	Malt	1
Cake powder	1	Malt extract	6
Calf meal	2	Malt nutrine	1
Canned strawberries	1	Malt vinegar	5
Cheese	11	Malted milk	2
Cherry brandy	1	Maple sugar	2
Chloroform	5	Maple syrup	11
Cider	1	Maraschino cherries	1
Cloth	2	Marmalade	3
Cloves	8	Milk	38
Coffee	16	Mineral seal oil	6
Condensed milk	1	Morphia sulphate	1
Cooking compound	1	Morphine tablets	1
Cotton seed meal	1	Mustard	5
Cream of tartar	5	Nature's plant food	1
Cream of tartar substitute	1	Nerveline	3
Creola	1	Oil	1
Cresylone	1	Oil cake	1
Crude oil	1	Olive oil	4
Disinfectants	4	Opium	1
Diastase	1	Paint	9
Dried distillers' grains	1	Pastilles calmantes	1
Epsom salts	3	Peas	1
Ether	2	Peat	1
Evaporated apples	17	Pectin	1
Evaporated milk	7	Pepper	3
Extract lemon	2	Perolin	1
Feeds	4	Port wine	1
Fertilizers	10	Rosin	9

SESSIONAL PAPER No. 14

Salve	1
Sausages	11
Screenings	1
Spent ginger	1
Spirits	190
Spruce	1
Sugar	3
Sugar beer	1
Sundries	6
Tea	11
Temperance beer	1
Vanilla extract	2
Vinegar	13
Water	15
Wax	1
Wescol	1
Wine	4
White lead	5
Wood alcohol	1
Grand total	729

Vinegars tested for excise 205

Solutions supplied—

Normal soda	Winchesters	95
" acid	bottles.	8
Phenolphthalein	"	7
		110

In conformity with a suggestion made last year, and accepted by yourself, I am furnishing, for inclusion in this report, only the introductory prefaces to bulletins published during the year. These prefaces take note of important conclusions reached as the result of work done. The details as to samples examined, specific analytical results, names and addresses of vendors and manufacturers, etc., are given in the bulletins themselves; and these are available to any person interested, on application to the Deputy Minister or to myself.

I have the honour to be, sir,

Your obedient servant,

A. McGILL,

Chief Analyst.

BULLETIN No. 338—SAUSAGES.

OTTAWA, 12 April, 1916.

SIR,—The present report deals with work done upon one hundred and forty-one (141) samples of sausages; mainly with intent to discover the character of these goods as found in Canada, but also to ascertain whether or not certain modes of treatment not permitted to manufacturers who work under government inspection are in use by sausage manufacturers whose establishments are not supervised by the inspectors of the Department of Agriculture. This has particular reference to the use of dyes, and preservatives.

It has not been considered necessary to make exhaustive analyses upon all the samples, and the work herein reported may be summarized as follows:—

Examined as to	Moisture content	60	samples.
" "	starch content	80	"
" "	dyes	141	"
" "	preservatives	30	"
" "	ash content	20	"
" "	proteid content	20	"
" "	fat content	20	"
" "	bacterial	9	"

Sausages are defined as follows, by Order in Council of 14th October, 1910 (published as G. 931):—

"2. Sausage, sausage meat, is a comminuted meat from swine or neat cattle or a mixture of such meats, either fresh, salted, pickled or smoked, with added salt and spices and with or without the addition of edible animal fats, cereals, blood and sugar, or subsequent smoking. It contains no larger amount of water than the meats from which it is prepared contain when in their fresh condition, and not more than ten per cent of its weight of cereals; and if it bears a name descriptive of kind, composition or origin, it corresponds to such descriptive name. All animal tissues used as containers, such as casings, stomachs, etc., are clean and sound and impart to the contents no other substance than salt."

Moisture (Water) Content. This is required not to exceed the amount of moisture natural to the meats from which it is prepared. In this connection the following constants possess interest. They are taken from Leach "Food Inspection and Analysis", 2nd Edition, p. 213, et seg.

Beef as usually purchased.

	Chuck.	Ribs.	Loin.	Rump.	Round.	
Lean	57·4	52·6	58·2	56·6	64·4	Water.
Medium	57·9	43·8	52·5	45·0	60·7	Water.
Fat	53·3	39·6	49·2	36·2	54·0	Water.

Pork as usually purchased.

	Shoulder.	Loin.	Ham.	
Lean	44·9	46·1	59·4	Water.
Fat	——	41·8	33·6	Water.

Of the total water present in sausages, it is generally accepted that the lean sausage meat contributes about 76 per cent the fatty tissue, from 3 to 8 per cent, and the starch or flour from 10 to 15 per cent (Allen Com. Org. Analysis, Vol. VIII, p. 361)

König (Jusammensetjung, etc., p. 1460) quotes 48·24 p.c. water for the mean of many analyses of pork sausages.

The results of analysis in the case of the present collection, and so far as water is concerned, are as below:—

Average for	10	samples from	New Brunswick	48·3 per cent.
"	10	"	Toronto	51·9 "
"	10	"	Hamilton	49·4 "
"	10	"	Alberta	43·9 "
"	10	"	Rocky Mountains	50·6 "
"	10	"	Vancouver	43·8 "
Average for	60	samples		48·0 per cent.

Starch Content of Sausages. The standards above quoted require that starch shall not exceed 10 per cent. As a matter of fact, our analytical results show that much less than this amount is usually present.

In the case of 80 samples examined, 75 samples contain starch. The average starch content is 3·14 per cent. In greater detail, the results are:—

For	10	samples from	New Brunswick	7·44 per cent.
"	10	"	Toronto	2·12 "
"	9	"	Hamilton	1·76 "
"	10	"	Manitoba	1·68 "
"	10	"	Saskatchewan	2·09 "
"	7	"	Alberta	3·89 "
"	10	"	Rocky Mountains	2·28 "
"	9	"	Vancouver	4·10 "
Mean starch for	75	samples		3·14 "

Dyes are present in 13 out of 141 samples examined. Dyed sausages were found as follows: in Montreal 5 samples; in Ottawa 4 samples; in Toronto, 2, and in Hamilton and Windsor, each, 1.

BULLETIN No. 339—SWEET SPIRIT OF NITRE.

OTTAWA, May 3, 19[illegible].

SIR,—I beg to hand you a report upon eighty-five (85) samples of Sweet Spirit of Nitre (*Spiritus Aetheris Nitrosi*) procured by our inspectors during November and December of last year, in the districts of Manitoba and Saskatchewan.

This article has been made the subject of inspection under the Adulteration Act, on four different occasions, namely in 1891 (Bulletin 23), in 1908 (Bulletin 167), in 1911 (Bulletin 234), and in 1913 (Bulletin 255).

I may quote, in this connection, as follows from my introductory letter to the last named Bulletin.

"This important drug has on two former occasions been the subject of inspection, and has always been found to show a high percentage of adulteration; consisting not in the addition of foreign matters, but in containing less of the active principle (Ethyl Nitrite) than the standard set by the pharmacopœia requires.

"As has been pointed out in former bulletins, and emphasized by the pharmacopœias, the article is prone to decomposition and, unless kept with special care,

will always deteriorate in the hands of the dealer. This fact is so well known to the drug trade that physicians have a right to expect special care on the part of the druggist, who is properly held responsible for the quality of the drugs he dispenses. The following table presents the results of three inspections of Sweet Spirit of Nitre:—

Bulletin.	Year.	Total samples.	Genuine.	Adulterated.
			p. c.	p. c.
167	1908	77	37	63
234	1911	74	57	43
255	1913	73	56	44

The minimum amount of Ethyl Nitrite required by the British Pharmacopœia is e and three-quarters per cent (1.75) by weight. Of the collection now reported, 44 per cent of the samples contain less than this amount; 30 per cent contain less than 1 per cent of Ethyl Nitrite; 14 per cent contain less than one-half of 1 per cent; while nearly 9 per cent of the samples contain none at all.

"Although the names of the manufacturers, or furnishers as supplied by the vendor, are given in their proper places in the appended table, it is but right to insis that responsibility for the quality of Sweet Spirit of Nitre should rest upon the immediate dealer, or vendor of the article. There is no reason to believe that any manufacturer of repute furnishes this drug otherwise than up to standard strength. The name of the manufacturer or furnisher is given in accordance with secti n 19 of the Act, and not because of any proved negligence on his part.

"; is abundantly evident, in view of the continued sale of this drug in a condition which it seriously handicaps the physician, and imperils the well-being of the p ent, that druggists must be made to realize their responsibility in dispensing drug which fail to meet the standard set by the pharmacopœias.

xperiments made by the late Franklin T. Harrison, Public Analyst, proved that veet Spirit of Nitre made according to British Pharmacopœal directions can kept, without change, for a year, under proper precautions. (See Bulletin No. p. 7.)

f this important drug cannot be procured by physicians in such condition as the harmacopœia requires, it should either be removed from the pharmacopœia altog ther, or physicians must learn to employ it in full knowledge of its doubtful char cter and be prepared for most erratic and uncertain results.

"The fact is that it can be prepared and kept by careful and intelligent druggists, and that this is not done must be regarded as a disgrace to the drug trade, and a very serious menace to the public."

The results of the present inspection may be summarized thus:—

	Samples.
Found to meet B.P. requirements	4
" correct as to content of Ethyl Nitrite	31
" approximately correct as to Ethyl Nitrite content	12
" to contain decided excess of Ethyl Nitrite	19
" to contain marked deficiency of Ethyl Nitrite	19
Total	85

It is to be noted that the revised pharmacopœia of 1914 makes some slight change in the standard for this drug as below:—

	1898.	1914.
Method of preparation..	Unchanged.	
Ethyl Nitrite in freshly prepared spirit..	2·5%	2·66%
Specific gravity..	0·838	to 0·842
Ethyl Nitrite as dispensed: minimum..	1·75%	1·52%
" " maximum..	2·50%	2·66%

Since the revised pharmacopœia of 1914 has but recently come into recognition in Canada, it is fair to interpret the results of analysis in such a way as to conform to either the edition of 1898 or that of 1914. As a matter of fact the differences as far as this drug is concerned are negligible.

It will be noted that, in the matter of specific gravity only five (5) samples fall within the limits fixed by the pharmacopœia. Fifty-four (54) samples have a specific gravity below 0·838 and twenty-six (26) samples have specific gravity above 0·842.

The latter are doubtless prepared with weaker alcohol than 90 per cent.

Samples (12 in number) which do not deviate more than 0·5 per cent from the minimum percentage of Ethyl Nitrite fixed by the pharmacopœia, I have felt justified in describing as approximately correct, in their Ethyl Nitrite content.

Nineteen (19) samples, containing less than this must be described as adulterated under the Act. The percentage of adulteration is 22, and indicates a very considerable improvement when compared with the results of former inspections.

BULLETIN No. 340—GROUND COFFEE.

OTTAWA, May 4, 19[illegible]

SIR,—I beg to hand you a report dealing with four hundred and seven (407) samples purchased as Coffee in December, January and February last.

The results of this inspection may be summarized thus:—

Found genuine..	341	samples.
Passed, as containing less than 10 per cent, foreign matter..	12	"
Passed as labelled mixtures..	16	"
Doubtful, for reasons given below..	3	"
Adulterated under the Act..	35	"
Total..	407	"

Five (5) of the samples judged as genuine contain minute amounts of chicory or other foreign matter; but the amount is too small to be regarded as other than accidental.

Twelve (12) samples containing small amounts, generally much below 10 per cent. of foreign matters, are passed without being adjudged as adulterated. It may be that in some of these cases the foreign matter is present accidentally. In a strict interpretation of the results of analysis, these samples are undoubtedly adulterated; and it must not be understood that my action prejudices any future decisions in similar cases.

Three samples are classed as doubtful. See No. 55434, the fact that the article was a compound, was not stated until the purchase had been made.

No. 55447 contains both chicory, and roasted grain. The presence of chicory is dèared on the label, but no mention of the presence of roasted grain is made.

. The same is true of No. 52326.

The percentage of genuine samples in this collection is 83·5, indicating a slight faing off since 1910, when a report upon two hundred and ninety-seven (297) samples slwed 88 per cent. to be genuine.

BULLETIN No. 341—HOUSEHOLD AMMONIA.

OTTAWA, June 15, 1916.

SIR,—Of late years Ammonia has come to be largely in use in the household, as a d ergent and for the convenience of persons in whose hands the strong solution of amonia would be attended with danger, manufacturers have placed on the market a dute ammonia under the name of Household Ammonia, which finds very extensive sae. For the most part, this article is simply a dilution with water of the strong solutin (Liquor Ammoniae Fortis) of the Pharmacopœia. This latter is required to cotain 32·5 per cent by weight of Ammonia (NH^3). A weaker solution is also defined b, the Pharmacopœia (Liquor Ammoniae) containing 10 per cent by weight of Ammoa. It may be mentioned here that the Ammonia of the French Codex contains only 2·18 per cent and the Aqua Ammoniae Fortior of the United States Pharmacopœia, 28 per cent by weight of Ammonia.

Some market samples of the article contain, in addition to Ammonia, soaps of various kinds, and other ingredients.

In January 1914, Professor J. F. Snell of Macdonald College, presented to the Canadian Section of the Society of Chemical Industry a study of Commercial Household Ammonia in Canada. (See Journal of the Society, 1914, p. 1177) and recommended that a more extended inspection of the articles be made under the Adulteration Act.

Ammonia, considered as a drug, undoubtedly comes under the purview of this Act. While Household Ammonia cannot be described as a drug in the strict sense, it has been thought well, in the interest of the public generally, to examine this article, and the present report deals with the more or less complete analysis of one hundred and sixty-two (162) samples, purchased by our inspectors as Household Ammonia, in December, January and February last.

Professor Snell reports upon the Analysis of 10 samples of clear ammonias, 5 samples of so-called cloudy Ammonias (containing soaps), and 6 samples of solid Ammonias (essentially carbonate of ammonia) and finds, for the liquid preparations, that "the household Ammonia sells wholesale at from 4 to 14 times the wholesale value of the Ammonia contained in it. The retail price is from 6 to 20 times the wholesale value of the Ammonia," and adds, "How much more economical it would be to buy commercial concentrated ammonia, and dilute it with good soft water."

There is of course a certain convenience in purchasing the article in a form ready for use, and that the average consumer is willing to pay for this service is amply evident when we consider the extensive sale of many foods in neat packages, which could be purchased at much less cost in bulk. It is however, a reasonable claim, when the purchaser asks how much in excess of its minimum market value he pays for the advantage of package, or in the case of Household Ammonia, of dilution and package. It is certainly with surprise and indignation that the purchaser learns of the six-fold increase found by Professor Snell.

With a view to establishing as far as possible, a relation between value and price of these articles I have tabulated (see Table II) the results of analysis, grouping

together samples bearing the same name (Brand). On account of the difficulty attending exact measurement of containers the information given in Table II must be regarded as approximate only.

From this it is seen that one unit of Ammonia, purchased in 12 ounce bottle, costs from 1·877 of a cent (cheapest) to 12·918 cents; the average cost being about 3 cents.

In order to obtain some idea of the cost of the same quantity of Ammonia, in twelve ounce package, bottle included, I caused four samples to be purchased in Ottawa, and Hull, and found these to cost 35 cents, in each case. The Ammonia values were found to be 23·14; 22·54, 21·98 and 23·24; giving a mean value of 22·72 per cent. The value per unit, is thus found to be 1·540 cents.

It is to be noted that this is the cost of a pure Ammonia, and a less highly purified article may be purchased at a considerably lower price. In a general way it may be said that our examination of so-called Household Ammonia essentially substantiates the findings of Professor Snell, and leads to the conclusion that the consumer can effect a substantial saving, by purchasing liquid Ammonia and diluting with water to suit his purposes.

I would respectfully suggest publication of this report as Bulletin No. 341. It contains information which will be helpful to many questioners regarding possible household economies.

BULLETIN No. 342—LIQUID EXTRACT OF NUX VOMICA.

OTTAWA, May 20, 1916.

SIR,—I beg to hand you herewith a report upon nineteen (19) samples of the Liquid Extract of Nux Vomica. This is not to be regarded as a comprehensive inspection of the important drug named, but as an attempt to ascertain what, if any, ground exists in fact for certain complaints made by physicians as to the varying and unsatisfactory results obtained in practice with the Liquid Extract of Nux Vomica. The samples now reported were purchased in Montreal and Toronto only. Their examination is considered, as will be seen to justify a more extended inspection; and the present report is to be regarded as preliminary.

It must be conceded that a certain degree of unsatisfactoriness exists regarding the valuation of this drug. It is prepared from the seeds of Nux Vomica, in No. 20 powder, by repercolation with 70 per cent alcohol. The percolate from a given weight of powder is equal, in units by measure, to the units of weight employed (grammes and cubic centimetres) in the British Pharmacopoeia of 1898; in the revision of 1914, the percolate is only half of this volume. In each case, the strychnine content of the percolate is determined, and the Extract is finally adjusted by addition of 70 per cent alcohol, to contain 1·5 percent of strychnine (weight in volume).

The seeds of *Strychnos Nux Vomica* contain two alkaloids, strychnine and brucine, whose physiological properties appear to be very similar, although the activity of brucine is much less than that of strychnine. Thus, the dose of Strychnine is fixed at 1/64 to 1/32 grain (B.P. 1914), while that of brucine is given as 1/10 to 1/2 grain. (Squires' Companion to the Pharmacopoeia, Ed'n 1908.) Both of these alkaloids are naturally present in the Liquid Extract; and if they were present in the Seeds of Strychnos in a constant ratio, it would of course be possible to infer the amount of either by a determination of the other. Unfortunately this is not the case; and the ratio of strychnine to brucine has been found to vary between 3 to 1 and 1 to 2. (Squire, p. 810).

In the assay of the percolate from powdered Nux Vomica, the preliminary steps are identical in both the 1898 and the 1914 editions of the British Pharmacopoeia. The separation of the two alkaloids was effected, however, in the Edition of 1898, by

ecipitation of the strychnine with potassium ferrocyanide, in sulphuric acid solu-on, and subsequent decomposing of the strychnine ferrocyanide. It has been found Schweissinger (Allen, Com. Org. Analysis, VI, 446) that under these conditions ucine ferrocyanide is co-precipitated, to some extent, thus affecting the accuracy the method.

In the Edition of 1914, the brucine is destroyed by oxidation with nitric acid in esence of sulphuric acid, and it is claimed that this method yields more accurate sults for strychnine. In illustration of the results of work done upon the same mple by both methods, I may quote the following:—

Sample.	Method of 1898.	Method of 1914.
64627	1·45	1·32
64628	1·54	1·45
64629	1·49	1·35
62636	1·26	1·24
62637	1·49	1·32
62640	0·88	0·92
64632	0·95	0·95

will be seen that in most of these cases a somewhat higher apparent strychnine ntent is obtained with the older (and now no longer official) method.

There can be no doubt that most of the Liquid Extract of Nux Vomica now on ie market has been assayed by the method given in the pharmacopoeia of 1898; and, ideed, in a strict sense this is the only method recognized by our Adulteration Act, which Section 7 (a) specifically names the Edition of 1898.

Under these circumstances, and inasmuch as the collection of the samples now ported was restricted to two localities, I think it inadvisable that the names of ealers or manufacturers (as stated by the vendors) should be given.

Quite apart, however from this consideration the results of analysis are instruc-ve, and serve to show that variations in the composition of the Liquid Extract of Nux Vomica exist, apart from the strychnine content.

The analytical results given in the following table were obtained by Mr. A. J. andry, of this staff, working by the official method of the British Pharmacopoeia, Edition of 1914.

LIQUID EXTRACT OF NUX VOMICA.

Sample.	Total Solids. Grm. per 100 cc.	Alcohol. Vol. p.c.	Strychnine. Grm. per 100 cc.
64626	11·50	59·72	0·78
64627	15·90	59·72	1·32
64628	14·96	54·48	1·45
64629	17·07	50·98	1·35
64630	15·38	65·32	1·44
64631	11·00	36·16	0·91
64632	2·25	74·32	0·95
64633	16·26	64·96	1·44
64634	11·78	68·32	1·57
64635	15·92	58·96	0·78
64636	25·36	36·52	1·46
64637	15·42	56·92	1·31
62636	11·83	61·20	1·28
62637	13·50	67·56	1·32
62638	18·06	50·32	1·59
62639	9·70	....	0·78
62640	12·02	....	0·92
62641	9·44	46·44	1·43
62642	14·48	....	0·76

Mr. Landry reports the usual difficulties attending the estimation of small quantities of alkaloids in solution with fats, vegetable matters of varying kinds and more or less vegetable tissue and colouring; and his duplicates indicate a variation of from 0·01 to 0·15 in strychnine found. Accuracy is only possible where the mean of several carefully conducted determinations is taken.

I know Mr. Landry to be a careful worker, and am convinced that the results given indicate within very narrow limits, the actual strychnine present. The *modus*

operandi for preparation of the Liquid Extract is strictly defined by the pharmacopoeia; and, unless the crude drug varies greatly in its quality, it is difficult to account for the differences in total extractive matter, except on the assumption of carelessness in manufacture.

The British Pharmacopoeia of 1898 did not standardize the powdered drug. The edition of 1914 fixes this at 1·25 per cent of strychnine, and prescribes the addition of milk sugar to adjust this value, within a limit of accuracy of 0·05 per cent excess or defect.

The total solids are found to vary, in these samples, from 2·25 per cent to 25·2 per cent. These extreme differences do not correspond to the variation in strychnine content; the sample giving only 2·25 per cent of total solids contains 0·95 per cent of strychnine; whilst that giving 25·36 per cent solids, yields but 1·45 per cent of the alkaloid. The pharmacopoeal standard requires 1·50 per cent strychnine. Most of the samples which approximate to this percentage show about 14 to 16 per cent total solids. It appears reasonable to suppose that a normal sample of the crude drug should, on definite treatment as prescribed by the pharmacopoeia, yield an extract of approximately constant character as regards dissolved solids. This matter requires investigation.

Alcohol of 70 per cent strength is prescribed; and there can be no sufficient reason for a variation in strength of from 36·16 to 74·32 in the finished extract.

I beg to recommend that this subject be more fully investigated in the near future; and that the present report be published as Bulletin No. 342.

BULLETIN No. 343—SUGAR.

OTTAWA, June 12, 1916.

SIR,—I beg to hand you a report upon 175 samples purchased as Sugar and 76 samples purchased as Icing Sugar, by our inspectors in December, January and February last.

Standards defining Sugar and Icing Sugar were established by Order in Council under Section 26 of the Adulteration Act, on August 1, 1914, and are published as G. 1135 bearing date August 6, 1914, as follows:—

SUGAR.

1. Sugar is the product chemically known as Sucrose (Saccharose) and is at the present time found in commerce as obtained from Sugar Cane, Sugar Beets, Sorghum, Maple and Palm.

2. Sugar whether sold as granulated, loaf, cut, milled or powdered sugar shall contain at least 99·5 (ninety-nine and five-tenths) per cent of sucrose, and shall be free from any artificial colouring matter.

3. Icing sugar is a powdered sugar specially prepared for baker's use, and may contain starch, not to exceed five (5) per cent by weight.

The standards above defined take effect on the 7th day of September, 1914.

The results of examination may thus be summarized:—

Sugar (see Table 1).

	Samples.
Found genuine refined Sugar	143
" " brown Sugar	25
" adulterated, as containing a dye	6
Passed, as being very close to the standard	1
Total	175

Sample No. 4003, contains 99·3 instead of 99·5 per cent sucrose.

The following samples contain a blue dyestuff (apparently ultramarine) and in this respect violate standard requirements: 67498, 70567, 70108, 71947, 71953, 52310.

Standards for partially refined Sugar, have not been defined; and samples sold as brown Sugar, or yellow Sugar, are all found to be genuine, in the sense of being true to name.

Icing Sugar (see Table 11).

This form of sugar is permitted to contain starch, not in excess of 5 per cent, by weight. A small quantity of starch is apparently necessary in order to prevent the lumping of the article, when the atmospheric conditions are not satisfactory. A very small amount of moisture in the air causes finely powdered sugar to form lumps, and it is found that a small quantity of dry starch prevents this, while not interfering with the use for which the sugar is intended. It appears to be well established that from two to three per cent of dry starch is quite sufficient for this purpose. Our standards permit starch to be added, not to exceed 5 per cent.

In the case of 16 samples it will be seen that our inspectors have been supplied with powdered sugar, containing no starch, and answering the requirements of refined sugar. In four cases the excess of starch is less than 1 per cent, and I have recommended that these samples be allowed to pass. The results of examination may be thus exhibited:—

	Samples.
Found genuine as Icing Sugar	50
" within 1 per cent and passed	4
" to be refined Sugar	16
" to contain decided excess starch	4
No. 3665 nearly refined Sugar	1
" 71957 containing almonds	1
	76

This is the first occasion upon which sugar has been systematically inspected, since fixation of standards. A limited inspection of sugars was made in 1891 and is reported in Bulletin No. 25. In 21 samples of white (refined) sugar the sucrose was found to vary from 98·84 to 99·8 per cent, averaging 99·26 per cent. In 22 samples of yellow sugar, from 86·00 to 94·9 per cent sucrose was found, the average being 90·23 per cent.

BULLETIN No. 344—SPIRIT OF CAMPHOR.

OTTAWA, June 27, 1916.

SIR,—I beg to hand you a report upon Spirit of Camphor.

This article is defined by the British Pharmacopœia (1914) as consisting of 100 parts by volume of 90 per cent alcohol, containing 10 parts by weight of Camphor in solution.

The specific gravity should be between 0·845 and 0·850; and the optical rotation should not be less than 4° at 15·5° Centigrade.

The formula is essentially identical with that given in the edition of 1898.

Our last general inspection of Spirit of Camphor is reported in Bulletin No. 178 (March, 1909). On that occasion, 74 samples were examined as regards alcohol only; and it was considered fair to accept 75 per cent of alcohol as a reasonable minimum in the product as dispensed. This allows a very considerable margin for evaporation due to repeated opening of the container.

The Camphor content should approximate 10 per cent (weight in volume); and although Camphor is more or less volatile from solution, it is relatively less so than alcohol, so that its proportion is likely to increase, rather than diminish in stock solutions. I have therefore considered that anything below 8·5 per cent weight in volume indicates an adulterated article.

The present report deals with 168 samples purchased as Spirit of Camphor. Five samples are evidently accepted by our inspectors in mistake, four of these accepted by Mr. Gendreau being Gum Camphor, and one (No. 62916) being alcohol only.

Nineteen of the remaining samples depart so slightly from the Standard as above interpreted, that I have passed them. The following synopsis presents the detailed results:—

Meet legal requirements	126	samples.
Passed, as within narrow limits	20	"
Adulterated, as deficient in camphor	5	"
" " both		
" camphor and alcohol	9	"
" as containing methyl alcohol	3	"
Purchased by mistake	5	"
Total	168	

The substitution of methyl alcohol in whole or in part for ethyl alcohol in Spirit of Camphor, necessarily constitutes adulteration; under the Adulteration Act. It is also forbidden by Section 7 of the Amendment to the Inland Revenue Act, dated April 10, 1908, unless the presence of methyl alcohol is declared upon the label of the container.

I am informed that there is a certain demand for a low-priced Spirit of Camphor, for veterinary use, and that this is frequently prepared with denatured alcohol, or with Columbian Spirit. However this may be, it furnishes no excuse for offering the article as pharmacopoeal Spirit of Camphor.

BULLETIN No. 345—EVAPORATED MILK.

OTTAWA, July 6, 1916.

SIR,—I beg to report certain work done upon a limited collection of samples (73 in number) of evaporated milk. These have been examined with the view of ascertaining whether any ground in fact existed for certain complaints to the effect that the metals of the container (tin and lead) were taken into solution by the contents when these developed an acid reaction.

Acidity has been determined in 17 samples, and is found to vary from 28·8 to as high as 46·4, when stated as cubic centimetres decinormal per 100 grammes of the sample. The full meaning of this as tending to render soluble the metal of the containing vessel has yet to be worked out.

In another series of samples tests were made for tin and lead. Practically no determinable quantities of lead were found in solution. Tin was found in 44 samples, the amount varying from a mere trace to as much as 62 milligrammes per 100 cubic centimetres; or 620 parts per million (about 4 grains per pound or 0·062 per cent).

Regarding the effect of this upon health, I may quote Thresh and Porter (Preservatives, etc.; Churchill, London, 1906, page 204). "At the present time no one seriously contends that the amount of tin in solution in these (acid) foods has any

effect upon the system. As a rule the quantity is very small, rarely amounting to one grain per pound of food substance. *Mulenrieth.* (Laboratory manual, etc., trans. Dr. Warren, pub. Blakistons, Sons., Phila., 1915), page 174, says: "Hence tin vessels may be used, and preserved articles of food containing tin, have practically no deleterious action upon health." *Kunkel.* (Handbuch der Toxikologie, s. 216) says: "This is a very slightly poisonous metal. This is established beyond doubt." The extent, however, of its possibly poisonous action, he considers worth further investigation. Parry (Food and Drugs, Scott, Greenwood & Son, London), page 373, says: "There is no evidence of a cumulative action of tin, until the daily dose exceeds 2 grains. Dr. Buchanan states that the presence of tin in a sample, in quantities approaching 2 grains to the pound may be taken to signify that the food has become potentially deleterious to health." I have noted as excessive an amount of tin exceeding 2 grains per pound, or 0·03 per cent. This occurs in 9 samples out of 44 samples in which quantitative determination of tin was made.

I propose to carry this examination for tin and lead further, at an early date, and to attempt to correlate the acidity of the sample with the amount of metallic contamination.

As judged by the ordinary standards for evaporated milk, 46 samples in which the required determinations have been made give results showing them to be essentially up to standard requirements. Two samples were curdled, owing to incomplete sterilization. In six samples the non-fat solids are somewhat low. These are probably made from a rich milk which has been watered. The content in fat meets our standard for evaporated milk; viz. 7·2 per cent.

It may be noted that our standards requiring 7·2 per cent fat and 18·8 per cent non-fat solids were made legal in November 1910; and were at that time, identical with those obtaining in the United States.

In November 1914, an Amendment of the U.S.A. Department of Agriculture changed the standards so as to require 7·8 per cent fat and 17·7 per cent non-fat solids. This change was considered advisable because it was held that, in certain of the Western States, milk solids were normally lower than in the Eastern and Middle States; and that the deficiency obtained in the non-fat solids. So far as Canada is concerned the matter has not been fully investigated; but it may be that owing to differences in the feed and pasture, the same difference holds good. It seems only just to allow, in the meantime, for a possibility which has been established south of the boundary line.

BULLETIN No. 346—CHOCOLATE CANDY.

OTTAWA, July 27, 1916.

SIR,—I beg to hand you herewith a report dealing with the results of analysis of 151 samples purchased by our inspectors as chocolate candy.

Attention has been drawn, by various large manufacturers of confectionery to the employment of solid paraffin as a stiffener in certain brands of chocolate. One correspondent writes as follows: "We wish that the Government would be as particular in regard to the adulteration of chocolate and chocolate products in Canada, where substitutes are used for cocoa butter and other substitues for chocolate, as they are in regard to maple. We think it would be of advantage to every one if it were so. We have recently been advised by a salesman for paraffin wax, that the confectioners in Canada are using this very largely. This is an adulterant that has been cut out in almost every other country except Canada. We believe it is largely

used in the cheap chocolates referred to, for when they use a substitute for cocoa butter, they have to use something to stiffen up the chocolate coating."

The National Confectioners' Association of the United States, issued a Food Law Circular under date May 20, 1913, containing a list of substances prohibited in confectionery, among which appears paraffin.

The Food Laws of Illinois, Nebraska and Utah,' specifically forbid the use of paraffin in candy; and those of many other States are interpreted in such a way as to condemn its use.

It is certain that so-called paraffin or paraffin wax is wholly without food value; is quite indigestible, and is not a normal component of any natural food material. Its melting point (about 54·5° C. = 130·1° Fah.) is so high as to keep it solid at the body temperature, and being quite insoluble in the digestive fluids, it is conceivable that serious results might ensue from its presence in foods, consequent upon mechanical disturbances.

It will be noted that 126 samples are found to be genuine, in the sense of being essentially cocoa material, while seven samples contain more or less starch, as the only foreign matter. Ten samples show the presence of other fats than cocoa fat, and eight samples contain paraffin.

We have as yet, no legalized definition of confectionery specifically forbidding the use of paraffin. The report now handed you will constitute a basis for the study of this matter, with a view to recommending legislation.

BULLETIN No. 347—FERTILIZERS FOR 1916.

OTTAWA, September 6, 1916.

SIR,—I beg to hand you a report upon the examination of 365 samples of Fertilizers, representing the inspection of fertilizers under the Fertilizers Act of 1910, for the current year.

The results may be summarized as below:—

	Samples
Found to meet claims	330
Found to meet claims by compensated value	18
Found nearly to meet claims and passed	8
Found sold without registration number	2
Found below claims	7
Total	365

The deviations from guaranteed value are usually very small, and the report now in your hands shows an evident desire on the part of manufacturers of fertilizers, to live up to claims made. It is, however, to be noted that many fertilizers which in other years have claimed considerable amounts of potash, this year claim none, or notably smaller percentages than formerly. This is doubtless due to the scarcity of salts of potash, owing to war conditions.

Six brands of fertilizers make claims for very small amounts of potash, less than 0·50 per cent. These claims represent no tangible values, and I think that claims for less than 0·50 per cent should not be allowed. Our Act (section 15) specifically concedes a deviation of half of one per cent as possibly accidental, and as negligible, provided that the total value of the fertilizer is not materially affected by it.

In 18 samples the words "compensated value" are used. It is sufficiently evident that many manufacturers have confounded the terms available and soluble as applied

to phosphoric acid. The actual difference in value between water soluble and citric soluble phosphoric acid may be very small, and I have felt justified in recognizing this fact in interpreting the results of analysis. One sample (No. 70700) claims a total value so small as to render it practically useless as a fertilizer. It should not be found on the market.

BULLETIN No. 348—MAPLE SYRUP.

OTTAWA, 14th September, 1916.

SIR,—I have the honour to present you a report upon two hundred and nine (209) samples purchased as Maple Syrup, by our inspectors during the current year.

Of this number, one hundred and sixty-two (162) samples are found to be genuine, in the sense of meeting standard requirements for Maple Syrup as defined in G. 994 and G. 1152. Six samples meet these minimum requirements within such narrow limits as to justify suspicion of their genuineness, but I have recommended that they be passed; thus giving a total of 168 samples as probably genuine, being 80 per cent of the total collection.

Forty one samples are adulterated, in the sense of being mixtures of cane sugar syrup with maple syrup, but sold as Maple Syrup.

Our inspectors were instructed to demand Maple Syrup, and the samples now reported were supplied by the vendors as answering this demand. In two instances the vendor, after making sale, and discovering that the purchaser was an officer of this Department, stated that he did not claim the article sold to be pure Maple Syrup. In one of these cases the manufacturer's label upon the container, claims that the article is Maple Syrup; in the second case the label bears the words "Pure M Syrup", which is undoubtedly intended to make the purchaser believe that he is being served with Maple Syrup.

In most of these cases of fraudulent sale, the manufacturer's label distinctly claims the article to be Maple Syrup; and I have noted the presence of these words on the label where such label has been seen by myself or by the analyst, who did the work of analysis.

There can be no excuse for offering as Maple Syrup an article which is a mixture, as in these cases. The article may be, and in most cases is, a very desirable and nutritious food; but it should be placed upon the market under conditions which would correctly inform the purchaser as to its character. It is noteworthy that the uttering of the surrogate article appears to be entirely in the hands of a small number of manufacturers, in Montreal and Toronto. The great proportion of samples purchased in localities where Maple Syrup is recognized as an established farm industry, as in New Brunswick and Quebec, are found to be genuine; and there can be no doubt that a real injury is done to these provinces when the markets offered by our western provinces and our larger cities are supplied by imitations of Maple Syrup, which profess to be the genuine article.

BULLETIN No. 349—MACE.

OTTAWA, October 18, 1916.

SIR,—I beg to hand you herein a report upon the spice known as Mace. This is the first occasion upon which we have dealt with the article named, and owing to the

facts that comparatively little investigatory work is on record regarding this spice; that no accepted standards for it exist, and that even importers of the article are imperfectly informed as to its source and character, the report now placed in your hands must be considered rather as a study of the subject, than as a record of official inspection.

The attention of the Department has been called to the matter by several interested parties, from one of whose letters I quote the following:

> "Has your Department ever made a collection of this spice? The reason we ask is this. A good Amboyna or Penang costs at the present time (April, 1914) about 61½ cents per pound, while Bombay, which is a wild mace, can be purchased for 24 cents a pound. In order to reduce the cost per pound, the spice-grinders generally blend either of the first two with the latter. While Bombay is truly mace, yet it does not contain any essential oil, and has no flavouring power, and therefore really acts as a filler."

Mace is the arillus, or outer coating of the nutmeg, the seed of Myristica fragrans (British Pharmacopoeia.) "This tree is indigenous to the Molucca Islands, and is cultivated in Penang, Sumatra, the West Indies, etc. Penang nutmegs, which are the most esteemed, are very aromatic. Singapore nutmegs closely resemble them. Wild nutmegs are longer, narrower, and less aromatic. Bombay nutmegs, (M. Malabarica) are devoid of aroma. Of species of Myristica other than M. fragrans, only one, viz.: M. Argentea, the Papua nutmeg, yields aromatic seeds. Mace is the dried arillus. Considerable quantities of valueluess Bombay mace are imported." B. P. Codex, p. 652.

Mace, like the nutmeg, owes its value as a spice to its content of volatile oil, and according to Allen (Com. Org. Analysis, IV, 359) this oil is practically identical in nutmeg and mace. The Oleum Myristicae of the pharmacopoeia is stated by Allen to be a fraction only of the natural oil. Specifications for this oil, are somewhat changed in the 1914 edition of the B. P.

—	1898.	1914.
Specific gravity	0·870 to 0·910.	0·870 to 0·925.
Optical rotation	Not given	+13° to +30°.
Refractive index	"	(25°C) 1·474 to 1·484.
Solubility	In 1 vol. mixture equal parts absolute and 90% alcohol.	In 3 volumes of 90% alcohol.
Residue at temp. of boiling water	No crystalline residue	Not to exceed 5%.

That Bombay mace must be regarded as of no value for the purposes of a spice, follows from the above quotation from the B. P. Codex. In addition I may quote Kraemer. (Pharmacognosy, 1915, p. 256.) "Bombay mace is very largely used to adulterate genuine mace." Also Bailey (Food Products, 1914, p. 451.) "Bombay mace, which is often used to adulterate Penang and other true maces, has practically no flavour, and is of little more value than so much inert material."

Leach (Food Inspection, etc., 1909, p. 467) says: "Bombay mace, is almost entirely devoid of odour or taste, being nearly as inert as so much starch. It is most properly regarded as an adulterant from its lack of pungency, even though in a sense, it is a variety of mace."

U. S. A. standards for Mace, are as follows: (Circular 19, Dept. of Agriculture, Washington.) "Mace is the dried arillus of Myristica fragrans, and contains not less than 20, nor more than 30 per cent. of non-volatile ether extract; not more than 3 per cent. of total ash, and not more than 0·5 per cent. of ash insoluble in hydrochloric acid; and not more than 10 per cent. of crude fiber."

"Macassar mace, Papua mace, is the dried arillus of Myristica Argentea." "Bombay mace is the dried arillus of Myristica Malabarica."

Leach (Food Inspection and Analysis, 2nd edition, p. 466) quotes the following analytical results, obtained by Winton, Ogden and Mitchell upon samples of the three kinds of mace specified in the above standards:

1. True mace (means of 4 samples.)
2. Macassar mace.
3. Bombay mace.

—	1	2	3
Moisture	11·05	4·18	0·32
Ash total	2·01	2·01	1·98
Ether extract, volatile	7 58	5·89	4·65
" non-volatile	22·48	53·54	59·81
" total	30·06	59·43	64 46
Alcohol extract	23·11	32·89	44·27
Reducing matters by acid conversion, as starch	31·73	10·39	16·20
Starch, by diastase	27·87	8·78	14·51
Crude fibre	3·20	4 57	3·21
Nitrogen x 6·25	6·47	7·00	5·06

It will be noted that true mace is sharply distinguished from the other maces by its non-volatile ether extractive, which is much less than that yielded either by Macassar or by Bombay mace.

With regard to Macassar mace, Leach (op. cit.) says: "Macassar mace is sometimes designated as wild mace, but it is by no means as inert as the Bombay variety, and possesses a wintergreen like odour. Its taste, while distinctive, is not that of true Penang mace. It is distinctly an inferior article."

The value of the ethyl ether extractive as indicating the presence of Bombay mace is greatly enhanced if the sample be extracted with petrolic ether before applying the ethyl ether. (Parry, Food and Drugs, Vol. 1, p. 237.) Under these conditions, genuine mace yields only from 2 to 3·5 per cent. extractive to ethyl ether, while Bombay mace yields up to 33 per cent.

Macassar mace, however, behaves like Banda mace in this respect.

Qualitative tests for Bombay mace.

The microscopical characters of these various maces are not such as to satisfactorily distinguish them. Nevertheless, the oil glands in Bombay mace are so much redder than those of true mace, as to afford fairly good evidence of its presence.

Mr. Dawson suggests the possibility of utilizing the brilliant red produced in Bombay mace by treatment with dilute potassium hydroxide, as a means of quantitative determination in admixture.

Mr. A. T. Collins, Chemist to the Colburn Company, Philadelphia, has shown that, when mace is mounted in Canada Balsam, reduced by benzol, the cellular structures come out clearly under the microscope; and he claims that very small percentages of Bombay mace, in admixture with true mace, can easily be detected.

The Hefelmann and Schindler tests depend upon the fact that alcoholic extracts from Bombay mace differ from similar extracts of true mace, in yielding a decided red colour to paper through which they are filtered; and in giving a precipitate of reddish tint with acetate of lead. (Parry, op. cit., p. 237.) Waage's test consists in adding

potassium chromate to the alcoholic solution, when the solution becomes red, and the precipitate at first yellow, becomes red on standing, if Bombay mace is present. True mace gives a yellow solution and the precipitate does not turn red. (Leach, op. cit., p. 468.) The refractive index of the fixed oil of Bombay mace (at 35° c.) is somewhat lower than that of the fixed oil from other maces. Lythgae finds as follows:

For Banda mace oil.. .. .. 1·4747 to 1·4848
" Batavia mace oil.. .. .. 1·4893 to 1·4975
" Papua mace oil.. .. .. 1·4795 to 1·4816
" West Indian mace oil.. .. .. 1·4766
" Bombay mace oil.. .. .. 1·4615 to 1·4633

E. Spaeth (Leffmann and Beam, Food Analysis, 2nd ed., p. 309-10) extracted a number of samples of mace with petroleum spirit and determined the constants of the material obtained. The figures obtained from mace from Banda, Menado, Penang, Macassar, and *Z*anzibar closely agreed with each other:—

—	True Mace.	Bombay Mace.
Melting Point in open tube	25–26	31–31·5
Saponification Number	169·9 - 173	189·4–191·4
Iodine Number	75·6–80·8	50·4–53·5
Zeiss Refractometer at 40°	76–85	48–49
Index of Refraction	1·480–1·487	1·463–1·464
Meissl Number (Banda Mace)	4·1–4·2	1·0–1·1

In June of last year I was fortunate enough to secure, through the kindness of the late Mr. Grigg, Canadian Commissioner of Commerce, three samples of mace from Mr. E. H. S. Hood, Canadian Trade Commissioner of Barbados. These represent the qualities of mace exported from Grenada, B.W.I., and are described as:

No. 1. First quality.
No. 2. Second quality.
No. 3. Third quality.

The Superintendent of Agriculture for Grenada states that "he does not think there is any adulteration in the No. 3 sample, other than what may accidentally occur in the process of sweeping up the fragments from the curing floors or boxes. The differences in quality are mainly of colour, and strength of the aromatic oil as affected by the action of mildews during drying, and the length of time, and methods used in the curing process."

The three samples referred to were submitted to analysis by Mr. J. A. Dawson of this staff, who reports as follows:

Sample No. 1. Marked "Best Estates and Buyers" consisted of the clean arillus in whole condition, of a dull yellow colour, with reddish brown to pink along the edges. Weighed 465 grams.

Sample No. 2. Marked "2nd Best Estates and Buyers" was made up of mostly broken arillus of dull reddish to blackish brown colour, with few yellow pieces. One or two fragments of grass or bark. Weighed 463 grams.

Sample No. 3. Marked "Mace Siftings, Estates and Buyers" included small broken fragments of arillus of yellow, red and black or brown colours. Pieces of grass, bark, leaves and chips of wood, with a few whole seeds like peas or coffee beans. Several short pieces of thread, possibly from jute bags, and two dead insects. Weight, 487 grams.

In sampling, the whole contents of each package were spread out on a sheet of paper and thoroughly mixed. About 100 grams were weighed out and ground to pass a sieve of 1 sq. mm. Figures given are in all cases the mean of two determinations.

—	No. 1.	No. 2.	No. 3.
Total ash	1·50	1·70	2·10
Ash insol. in 10 % HCl	0·05	0·05	0·09
Non-volatile petrolic ether extractive	29·85	29·02	26·43
Non-vol. ether extractive after petrolic	1·14	1·43	1·55
Total ether extracts	30·99	30·45	27·98
Crude fibre	2·87	3·14	3·80
Refractive index of non-vol. petrolic ether extract	1·4791	1·4788	1·4821
Microscopic examination for Bombay mace	None.	None.	None.
Starch (iodine test)	Absent.	Absent.	Absent.

Two samples of mace obtained direct from Bombay, through the kindness of A. H. Ley, Esq., gave the following results:

Sample A. Known as "Chap" cost 1s. 10d. per lb.
" B. " "Ful" " 1s. 8d. "

—	A	B
Total ash	1·94	1·96
Insoluble ash	0·044	0·012
Crude fibre	3·80	3·60
Petrolic ether extract	20·95	20·94
Sulph. "	0·87	0 54
Total extractive	21·82	21·48

It is quite apparent that these samples are true mace, and not the Bombay or wild mace.

Two samples of Bombay mace supplied by a friend in Toronto, gave the following results:

—	C	D
Petrolic ether extractive	34·32	28·44
Sulph. ether "	25·04	27·56
Total extractive	59·36	56·00

These samples gave positive reactions with the Hefelmann and Schindler tests for Bombay mace.

The following work was done by Mr. Dawson upon a sample of commercial mace containing Bombay mace; and upon the components of this sample, separated as completely as possible, under the microscope.

	The Sample.	True mace.	Bombay mace.
	%	%	%
Non-volatile petrolic ether extract	20·96	24 07	22·43
" ethyl " after petrolic	7·24	1·83	42·30
Total non-volatile ether extracts	28·20	25·90	64·73
Ash	1·75	1·70	1·37
Ash insoluble in HCl	0·10	0·07	0·07
Crude fibre	2·91	3·00	4·80

It must be borne in mind that separation of the components is only approximately exact. The sample contained as adulterants, cereal starches, olive stones and turmeric, in addition to wild mace. The analytical results, especially as regards the ether extractive after petrolic ether, are sufficiently marked.

The percentage of Bombay mace present in a mixture with genuine mace may be determined from the formula,—

$$X \text{ equals } \left\{ E - \frac{G\,(100 - X)}{100} \right\} \times \frac{100}{B} \qquad (1)$$

X is the desired percentage of Bombay mace.
E is the per cent of non-volatile ethyl ether extract after petrolic in mixture.
G " " " " for genuine mace.
B " " " " for Bombay mace.

If the maximum values of 5% for G and 35% for B. assumed as constants, then the formula becomes,—

$$X \text{ equals } \frac{10\,(E - 5)}{3} \qquad (2)$$

In the majority of cases this formula will give results considerably too low. Applied to the above mentioned mixture, 7·5 per cent is indicated by formula (2), whereas 10 to 15 per cent was found by actual separation. However, if as found the value of 1·83 be given to G, and 42·30 to B, and E for the mixture is 7·24 using formula (1), then 13·3 per cent is indicated which is in good agreement with the results obtained by separation.

It is of course, necessary that the solvents employed should be entirely volatile at the temperature of the water bath. In a comparison of results obtained on the same sample with.

a = ether, redistilled below 40° C.
b = " containing 4 per cent. alcohol.
c = petrolic ether, redistilled below 40° C.
d = " " distilled between 40° C. and 75° C.

Mr. Dawson obtained the following results:

NON-VOLATILE EXTRACTIVE.

A	B	C	D
28·28 28·50	28·54 28·48	20·51 21·03	20·91 21·01
Mean .. 28 39	28·51	20·77	20·96

The results prove that slight differences in the quality of the solvent do not greatly affect the extractive.

TABLE 1.

It is of interest to place on record the following analytical results obtained in these laboratories upon 30 commercial samples of mace which appear to be genuine or to contain traces only of foreign material.

Number.	Ash.		Non-volatile extraction.			
	Total.	Insoluble.	Petrol ether.	Ethyl ether.	Total.	Crude Fib.
2606	2·40	0·20	26·67	1·82	28·49	4·45
41871	3·30	1·05	24·00	3·91	27·91	4·90
41872	1·90	0·15	21·50	4·04	25·54	3·95
41873	3·65	0·35	28·66	4·92	33·58	6·75
53683	2·40	0·35	23·08	2·32	25·40	4·00
55022	2·25	0·20	26·82	2·34	29·16	3 95
56277	3·80	1·00	30·10	1·88	31·98	4·75
58388	1·75	0·10	28·74	1·76	30·50	3·66
59532	2·65	0·15	26·96	4·26	31·22	5·20
59535	3 55	0·35	29·22	4·66	33·88	6·00
61036	2·90	0·25	26·02	3·06	29·08	4 50
62361	2·00	0·05	26·06	2·18	28·24	4·10
63426	1 95	0·15	25·86	2·50	28 36	3·60
63429	1·85	0·02	25·86	2·24	28 10	3·80
66162	1·66	0·12	27·60	3·32	30 92	
60373	2·33	0·37	25·06	3 68	28·74	
64218	2·32	0·20	26·00	4 72	30·72	
64220	2·32	0·22	28·74	3·82	32·56	
58401			23·60	2·60	26·20	
58403			30·04	1·84	31·88	
58404			31·30	1·60	32·90	
70598			26·56	0·72	27·28	
70521			31·06	0·80	31·86	
70523			26·64	1·92	28·56	
70522			30·62	0·80	31·42	
69965			31·80	1·20	33 00	
54681			28·08	6 62	34·70	
54692			28·96	3·68	32·64	
58470			22·72	1·08	23·80	
61415	1·84	6·10	27 20	2·90	30·10	2·85
means	2·46	0·28	27·18	2·77	29·96	4·39

TABLE 2.

In the following table I have brought together data obtained upon 95 samples of commercial ground mace which were found practically free from added starchy material, and whose principal foreign content is presumably Bombay mace.

Number.	Ash.		Non-volatile Extractive.				
	Total.	Insol.	Petrol. ether.	Ethyl ether.	Total.	Cr. Fib.	X.
52266	2·00	0·25	26·04	33·36	59·40	3·85	....
52267	3·90	0·60	17·62	20·56	38·18	7 65	66
52268	2·65	0·30	26·62	23·36	49·98	5·60	76
52269	1·80	0·15	24·84	34·42	59·26	4·05	....
52270	2·10	0·25	23·72	32 32	56·04	4·05	....
55372	2·55	0·30	22 02	29·08	51 10	5·20	96
55373	2·50	0·75	23·44	29·70	53·14	4·40	99
61888	2·45	0·20	26·06	25·82	52·88	5·20	88
66630	2·85	0·30	23·68	26·26	49·94	5·90	85
66636	2·55	0·35	24·64	28 02	52·66	5·55	93
66637	2·05	0 25	22·44	26·08	48·52	3·80	86
2135	2·10	0·30	26·58	17·76	44·34	3·80	56
2136	1·80	0·40	27·78	28·44	56·22	4·15	94
2137	2·15	0·15	26·12	22·48	48·60	4·25	73
2607	1·55	0·15	36·96	9·14	46·10	3·90	25
2844	3·90	0·75	22·30	23·06	45·36	6·75	75
41874	2·40	0·25	24·54	20·88	45·42	4·58	67
41875	2·10	0 15	26 84	9·92	36·76	3·80	28
51991	3·00	0·45	24·90	27·86	52·76	3·85	92
51992	3·15	0·45	24·18	25·92	50·10	6 85	85
51993	1·80	0·15	22·50	32·18	54 68	4 50	....
51994	1·90	0·30	27·54	34·46	62·00	4·10	...
51995	1·70	0·25	29·04	34·06	63·10	4·25	..
53685	1·90	0·20	21·54	26·36	47·90	5·45	87
55018	2·30	0·35	21·28	23·89	45·17	3·90	78
55020	2·90	0·45	25·78	27·10	52·88	6·90	89
56276	1·75	0·10	25·88	17·64	43·52	3 80	55
56278	1·85	0·40	26·50	32·78	59·28	5·00	...
56279	2·30	0·35	28·86	19·56	48·42	5·35	62
56280	2·00	0·15	23·82	15·78	39 60	5·80	49
59531	2·10	0·15	27·54	6·42	33·96	3·35	15
59534	2·00	0·20	23·72	24·98	48·70	4·35	77
61141	2·35	0·35	23·64	14·98	38·62	5·40	46
61142	2·45	0·25	27·44	27·26	54·70	5·60	90
61143	2·70	0·30	24·20	30·54	54·74	5·35	....
61144	2·26	0·20	22·50	15 16	37 66	4·50	47
61145	2·30	0·40	22·70	22·72	45·42	4·50	74
61531	2·20	0·25	20·20	27·42	47·62	4·20	90
61532	2·90	0·65	27·86	11·70	39·56	4·40	34
61533	2·50	0·25	26·38	24·24	50·62	4·45	79
61534	1·85	0·15	28·06	23 80	51·86	4·20	77
61535	1·95	0·15	26·34	18·44	44·78	4·20	58
61649	2·85	0·35	24 96	27·36	52·32	5·60	90
61926	3·05	0·50	20·38	34·46	54·84	6·30	....
61940	2·60	0·45	23·68	16·18	39·86	4·40	50
61942	2·75	0·45	29·36	10·58	39·94	4·90	30
62360	2·25	0·20	28·88	10·08	38·96	4·85	28
62363	2·55	0·40	21·96	18·44	40·40	5·15	58
63252	2·45	0·20	24·62	21·28	45·90	4·85	68
63254	2·35	0·45	24·60	32·02	56·62	4·95	....
63255	1·95	0·20	26·02	29·32	55·34	4·70	97
63256	2·05	0·15	24·54	20·66	45·20	4·05	66
63294	1·90	0·20	25·36	29·88	55·24	4·00	99
63295	1·95	0·15	25·82	19·66	45·48	4·95	63
63297	2·50	0·20	21·42	20·06	41·48	5·15	64
63298	2·50	0·25	24·28	25·08	49·36	4 90	82
63427	2·00	0·15	28·40	22·12	50·52	3·90	71
63428	2·20	0·15	26·14	7·18	33·32	4·45	18
63430	1·85	0·25	33·26	23·44	56·70	4·20	76
63751	3·00	0·15	26 84	17·96	44·80	8·05	57
63757	2·35	0·40	21·32	28 02	49·34	5·05	92
63760	1·90	0·15	27·16	23·66	50·82	4·60	77

TABLE 2—*Concluded.*

Number.	Ash.		Non-volatile Extractive.				
	Total.	Insol.	Petrol.ether.	Ethyl ether.	Total.	Cr, Fib.	X.
63764	3 10	0·15	27·70	20·78	48·48	8·25	67
63901	2·15	0·15	20·68	19·78	40·46	5·30	63
63903	1·75	0·20	24·00	32·66	56·66	4·05	...
63906	2·85	0·65	21·56	22·28	43·84	4·55	72
64006	1·75	0·15	28·80	19·60	48·40	3·80	62
64017	2·05	0·20	21·72	28·98	50·70	4 65	96
64024	1·90	0·25	22·06	37·90	59·96	4·65	....
56531	1·97	0·28	27·86	24·26	52·12		79
56532	1·62	0·15	27·88	33·88	61·76		
56533	1·81	0·17	25·04	21·89	46 93		71
56534	1·80	0 10	41·07	17·79	58·86		56
56535	1·78	0·15	28·55	28·86	57·41		95
66161	2·06	0·26	27·12	28·56	55·68		94
66163	2·03	0·19	28·40	8·99	37·39		24
66165	1·66	0·15	28·92	23 17	52·69		75
60374	1·90	0·22	25·86	24·42	50·28		80
60375	2·20	0·18	29·94	10·11	40·05		28
64219	1·65	0·14	26·60	28·59	55·19		94
64221	2·76	0·39	31·11	8·75	39·86		24
61412	2·90	0 20	21·34	19·90	41·24	3·65	63
61413	2·40	0·22	18·28	31·98	50·26	4 95	...
61431	2·36	0·30	24·28	9·96	34·24	4·10	28
69966			24·32	24·00	48·32		78
69967			29·44	22·18	41·62		72
69968			27·44	11·24	38·58		33
69969			26·10	16·00	42·10		50
70535			25·70	10·76	36·46		31
54504			24·68	10·54	35·22		30
54505			20·58	20·36	40·94		65
54688			25·70	23·40	49·10		76
70262			22·00	9·68	31·68		27
58469			26·60	24·06	50·66		78
58471			24·00	8·66	32·66		23

The trustworthiness of any formula employed to calculate the percentage of Bombay mace present in a mixture of this mace with the genuine, is dependent upon the accuracy of the constants involved. If we use as a basis of judgment the amount of extractive to ethyl-ether after petrolic, it is necessary to define the solvents, as well as the manner in which they are used; and also to determine the normal extractive by this method, for true mace and for Bombay mace respectively.

The samples enumerated in Table 2 were extracted in a Knorr apparatus, for 16 hours with petrolic ether (redistilled between 25° and 70° C.); then for a similar length of time with ethyl-ether (redistilled 35° to 37° C.) The extractive was dried to constant weight, at 110° C. The quantity operated on was 5 grams.

We have the following data for the extractive yielded by true mace:

	Per cent.	
Sample No. 1	1·14	Dawson.
" " 2	1·43	"
" " 3	1·55	"
" " 2606	1·82	"
" A	0·87	Valin.
" B	0·54	"
Sample separated from a mixture	1·83	Dawson.
Mean of 30 samples (see Table 1)	2·77	Various.
Penang mace	2·68	Parry.
Pale West Indian mace	2·04	"
Red " "	3·90	"
Sample No. 4	3·67	Valin.
" " 6	5·05	"
Mean value	2·25	

Data for extractive yielded by Bombay mace, under conditions above described:—

	Per cent.
Sample C	25·04
" D	27·56
Parry, Food & Drugs, page 237	29·11
Sample No. 5	32·69
Mean value	28·60

It will be noted that 14 samples of Table 2, yielded more than 30 per cent. extractive to ethyl-ether after petrolic. The mean extractive for these 14 samples is 33·35 per cent. Since these samples were found on careful qualitative examination to consist essentially of mace, it follows that some samples of Bombay, or other wild mace, must yield much more than the above average of 28·60 per cent. extractive. It is to be regretted that, at the time of writing this, I am unable to avail myself of fuller data for Bombay mace.

If we accept 30 per cent. as an approximate value for this mace, and take 2 as the corresponding number for genuine mace, the percentage of Bombay mace (x) in a mixture of the two maces, may be calculated from the formula,

$$x = \frac{100\ (e = 2)}{28}$$

where (e) is the extractive found for the sample.

The resultant values are given in the last column of Table 2. It must be understood that they are merely approximations to the actual percentage amounts of Bombay mace in these samples.

TABLE 3.

In this table I have arranged the results of analysis for 43 samples of commercial ground mace, found to contain other material than Bombay mace. In most cases this foreign matter is cereal or nutmeg starch, with turmeric.

Number.	Ash.		Extractive.			Crude Fibre.	Remarks based on microscopic examination.
	Total.	Insol.	Petrol.	Ethyl.	Total.		
55371.	1·45	0 15	18·65	24·88	43·53	3·15	Bombay mace and maize starch in large amount.
55374.	2·15	0·35	21·72	26·56	48·28	4·20	Much Bombay mace and small amount of starch.
55375.	1·85	0·15	20·06	25·10	45·16	3.95	Much Bombay mace and starch.
61893.	2·45	0·25	20·70	8 34	29·04	3·80	Small amount Bombay mace with much starch.
61895.	1·85	0·15	18·58	26·22	44·80	3·70	Much Bombay mace. Considerable starch.
68103.	2·05	0·25	19·28	22 54	41·82	3·80	" " "
68106.	2 85	0 20	18·88	10·28	29 16	4·80	Bombay mace small, much starch.
66619.	2·40	0·20	26·60	16·68	43·28	5·25	Bombay mace large amount and considerable starch.
66627.	1 75	0·15	23·06	25·48	48·54	3·10	Bombay mace much; also starch.
2608.	1·65	0·15	22·24	1·44	23·68	2·30	Much starch with turmeric.
55019.	2·00	0·25	19·47	27 72	47 19	4·80	Small amount starch much Bombay mace.
55021.	2·30	0·35	22·28	23·02	45·30	5·35	" " "
58386.	3·25	0·25	27·16	6·64	33·80	9 80	Bombay mace little, much starch.
58387.	1·55	0·10	24·12	0·74	24·86	2 25	Large amount starch, with turmeric.
58389.	3·20	0·30	26·78	6·38	33·16	7·85	Little Bombay mace and starch.
58390.	1·55	0·10	25·02	0·74	25·76	2·30	Much starch and turmeric.
59533.	3·30	0.70	24·20	10·32	34 52	5·05	Considerable Bombay mace traces of starch.
61620	2·20	0·45	21·84	25·58	47·42	4·65	Much Bombay mace.
61625.	1·90	0·25	19·08	21 24	40·32	3·50	" " little starch.
61641.	1·45	0 15	17·56	18·92	36·48	3·05	" " some starch.
61935.	2.05	0·10	27·66	17·44	45·10	3·65	Considerable Bombay mace and starch.
61938	2·30	0·45	22·12	24·00	46·12	4·70	Much Bombay mace, little starch.
62362.	2·05	0·10	25·56	0·58	26·14	3·20	Much starch and turmeric.
63253.	2·45	0·15	20·08	10·52	30·60	4·35	Considerable Bombay mace and starch.
63296.	2·70	0 35	23·08	21·60	44 68	4·95	Much Bombay mace, little starch.
63769.	1·95	0·20	19·06	28·76	47·82	4·35	Much Bombay mace and starch.
64021.	2·45	0·30	20·88	1·92	22·80	3·35	No Bombay mace much starch.
64023.	2·40	0·45	16·60	19·48	36·08	4·35	Much Bombay mace and starch.
66164.	1·81	0·17	26·78	17·50	44·28	.....	" " and some starch.
61414.	2·12	0·20	23·70	9·32	33·02	3·35	Some Bombay mace and starch.
58402.	.....	....	24·48	1·16	25·64	.....	15 to 20% wheat starch.
58405.	.... .	.....	23·80	1·68	25·48	. ..	" " "
70261.	..	.....	20·02	12·50	32·52	....	20 to 30% Bombay mace and starch.
70263.	.....	.....	23·04	26·68	49·72	.....	60 to 35% " "
70264.	.....	...	18·96	25·62	44·64	...	" " "
70265.	.. ...	.....	29·54	2·84	32·38	.....	No Bombay mace. 25 to 30% starch.
58467.	. ...	.....	27·50	24·00	51·50	.. .	50 to 60% Bombay mace and starch.
58468.	.... .	.....	27·66	1·92	29·58	.. .	No Bombay mace, 25 to 30% "
67466.	.....	.....	25·42	0·66	26·08	... .	" " 10 to 15% "
67467.	.....	..	25.58	2·20	27·78	...	" " " "
67468.	.....	.....	20·18	0·36	20·54	....	" " 20% "
67469.	.....	....	26·66	0·64	27·30	.. ..	" " " "
67470.	.....	.....	40·64	0·65	41 29	.....	Is ground nutmeg.

A study of the numerical results in Table III, taken in connection with the results noted from microscopic observation, leads to the conclusion that very definite inference as to the composition of these mixtures may be drawn from the extractive.

The presence of starch decidedly lowers the total extractive; while the ethyl-ether extractive plainly indicates the presence of Bombay mace. Where this is less than about 2 per cent. the absence of any considerable amount of Bombay mace is evident; and when in excess of 2 per cent. a close approximation to the actual amount present may be derived from a comparison of the ethyl-ether extractive with the total extractive.

The refractive index of the fixed oil from Bombay mace is given by Lythgae as varying from 1·4615 to 1·4633 at 35° C., while that from other maces varies from 1·4747 to 1·4975. The refractive indices for the fixed oils obtained from the samples included in Table 1, were read by Mr. Dawson at 35° C. and are found to be uniformly higher

than the maximum limit quoted for Bombay mace oil. Unfortunately this is also true for most of the samples recorded in Table 2, many of these, even when containing very high percentages of Bombay mace, (as judged from the ethyl-ether extractive) giving refractive indices of 1·4800 or higher. It would hence appear that, while the existence of a refractive index below 1·4700, points to the presence of Bombay mace, the finding of a higher reading than this cannot be regarded as evidence of the absence of Bombay mace.

The most conclusive chemical evidence of this adulteration of mace appears to be afforded by the ethyl-ether extract. In the case of Bombay mace, the resins seem to be less readily dissolved by petrolic ether than the fats. When these last are removed by petrolic ether, the subsequent extraction by ethyl-ether gives a number which is highly characteristic. It may be that alcohol, on account of its great solvent power for resins, might take the place of ethyl-ether, and effect a saving of time. This point may be investigated later.

Investigatory work done by Mr. Valin, since the above was written, has demonstrated certain points of importance in regard to details of operating. These are briefly:

1. The inadvisability of drying the sample at 100°—110° C. before extracting the fat and resins. Such treatment tends to make the extraction difficult.

2. The extractive matter is difficult to dry to constant weight, and an exposure of from 24 to 48 hours at 110° C. is required.

3. Extraction with petrolic ether is not usually complete in less than 16 hours.

4. The use of alcohol instead of ethyl ether, gives a somewhat higher extractive; but shows less characteristic difference between genuine and Bombay mace than does ether. For this reason it is not recommended.

The report now placed in your hands deals with 175 samples of mace, which are classified as follows:

Samples of known origin	7
" essentially true mace	30
" mixed with true and wild mace	95
" variously adulterated	43
Total	175

Their study would appear to justify the following standards for mace.

1. True mace is the dried arillus of Myristica fragrans (Houttyn.) It contains not more than three (3) per cent. of total ash, and not more than half of one per cent. (0·5) of ash insoluble in hydrochloric acid. Its crude fiber content does not exceed seven (7) per cent.

After extraction with petrolic ether, the ethyl-ether extractive does not exceed five (5) per cent. The total extractive by both solvents, does not exceed thirty three (33) per cent.

2. Macassar mace is the dried arillus of myristica argentea (Warb.)

3. Bombay Mace, is the dried arillus of myristica malabarica (Lamarck.) This mace must not be present in admixture with true mace, unless the label, or other mark clearly declares its presence, and approximate percentage amount.

It is recognized that the limited number of samples of certified origin included in this report, leaves much to be desired in the way of assured knowledge of the limits of variation which may obtain in different samples of the maces studied, where these are the production of different soils and localities. At the same time, I am convinced that no injustice will be done to importers by official adoption of the very liberal standards suggested; while a very much needed protection will thereby be afforded to the consumer.

SESSIONAL PAPER No. 14

BULLETIN No. 350—FEED FLOUR.

OTTAWA, November 2, 1916.

SIR,—I beg to hand you a report upon 170 samples of feeds, purchased under the name of Feed Flour.

This inspection has been rendered necessary in consequence of certain features of the operation of the Feeding Stuffs Act of 1909. These features were brought to your notice in my introductory letter published with Bulletin No. 311 (April, 1915). Briefly, they may be recapitulated as follows:—

Feeds which bear names of definite and distinctive character, are permitted to be sold without registration, because standards can be fixed for such feeds under Section 26 of the Adulteration Act.

The recognition of this class of feeds finds justification in the fact that all the smaller mills possess local markets for Bran, Shorts and Chop, as defined under our Act, and it is usual for farmers to buy direct from the mills. There is usually little or no accumulation of these feeds at the mill, the whole output being sold as produced. It would be an evident hardship were the miller required to keep distinct his product from each shipment of grain, and to furnish a guarantee of value with the sale. Such procedure would necessitate an increase in price to the consumer, and would not find favour with the farming community in whose interest the Act is framed. Experience gained since 1910 is decidedly favourable to recognition of a class of feeds of this kind; although the terms and standards fixed by Order in Council of May 1, 1911 (published as Circular G. 968) have been found to be unsatisfactory in several particulars.

Objections have been pointed out in Bulletins 254 and 311—and consequent upon these facts and others brought into notice through extended correspondence, it was considered desirable to invite comment by all parties interested, with a view to such amendment as might be found necessary.

In August of last year, a Circular (G. 1200) was extensively distributed through the kindness of the Canadian Manufacturers' Association, and through our own Food Inspectors.

Suggestions have been received from several of the larger milling companies and from a few of the smaller millers, but, upon the whole, it is felt that the subject has elicited less interest than its importance deserves.

Under the name of Special Shorts, or Choice Shorts, or Feed Flour or Low Grade Flour an article containing very nearly the same proteid and fat value as normal shorts, but a decidedly lower percentage of fibre, is offered. This variety is richer in starchy content than normal shorts, and is whiter in colour. Although its nutritive value is but slightly, if at all, higher than that of normal shorts, it commands a higher price, probably because of its appearance rather than for any other reason.

At a meeting of the Dominion Millers' Association held in Toronto on February 24, 1916, the present standards for the class of feeds now under consideration were discussed; and, amoung other business, a resolution was unanimously passed approving of the practical equivalency of the terms Shorts and Middlings, and recognizing the fairness of existing standards for this article.

It was however considered desirable and proper that an article generally known as Feed Flour, should be distinguished from Shorts; and the general impression prevailed that considerable latitude in the composition of this feed should be permitted. In order to obtain data for defining feed flour it was agreed that a collection of samples sold under this name should be made at an early date.

The samples herein reported were purchased in May and June of this year, for the purpose of establishing the nature of Feed Flour as sold in Canada.

Of 170 samples collected by our inspectors, under the name Feed Flour, 45 samples practically meet requirements for Shorts (Middlings) and must be regarded as such.

The outstanding feature in the article known as Feed Flour is its low content of fibre; and while frequently sold as Special Shorts or Choice Shorts, it is in reality a low grade flour. It usually commands a higher price than shorts proper, and appears to be regarded as superior to shorts, its superiority consisting in its whiter colour, its fineness, and its flour-like appearance. It usually shows a lower fat content than shorts, but its protein content is nearly equal to that of shorts.

It will be observed that I have excluded from the Feed Flour class all samples giving a higher fibre content than 2 per cent. From a large number of samples of flour examined by the Bureau of Chemistry, Washington, and reported in Bulletin 13, part 9, the following averages are taken:—

Patent Wheat flour (40 samples), crude fibre.	0·21	per cent.
Common Market flour (19 samples), crude fibre.	0·28	"
Bakers' and family (14 samples), crude fibre.	0·22	"
Mean.	0·24	"

In whole wheat flour, ground from the grain inclusive of its husk (bran) the crude fibre may amount to a little over 2 per cent; but all the samples now reported were evidently ground from the grain after removal of the bran; or the bran had been separated by bolting after grinding; and it is to a product closely resembling ordinary flour that the term Feed Flour is evidently intended to apply. Of the 125 samples now reported, 63 contain less than 1 per cent fibre; and 30 samples contain less than 0·5 per cent.

Fat Content.

Between 1 and 2 per cent fat.	23 samples.
" 2 " 3 "	47 "
" 3 " 4 "	44 "
Above 4 per cent.	10 "

Protein Content.

Above 18 per cent protein.	6 samples.
Between 17 and 18 per cent protein.	6 "
" 16 " 17 "	21 "
" 15 " 16 "	23 "
" 14 " 15 "	26 "
" 13 " 14 "	15 "
" 12 " 13 "	18 "
" 11 " 12 "	5 "
" 10 " 11 "	3 "
Below 10 per cent protein.	1 "

It is scarcely necessary to add that no vital weed seeds were found in any of these samples. The fineness of grinding precluded the possibility of this.

If it be asked whether in view of the data now reported, the Department would be justified in recognizing Feed Flour as a distinct article from Shorts or Middlings, I must confess to some hesitation in arriving at a decision.

If the point be conceded, it would seem reasonable to require Feed Flour to

approximate in composition to ordinary flour, in which case the subjoined standards would apply::

Moisture	not to exceed	13·5	per cent.
Proteids	" less than	10·0	"
Fat	" "	1·0	"
Fibre	" more than	1·5	"

The suggested standards are based on the composition of flours of a low grade, such as might naturally be looked for in flour offered for sale as a cattle feed. With a single exception (No. 5725) all the samples reported would meet such a standard.

The alternative mode of treating these feeds would be to require them to be marketed as registered feed, and sold on the basis of guaranteed value. Many of them so considerably exceed the minimum values suggested as standards for Feed Flours, that it would doubtless be to the advantage of the manufacturer to adopt this method, and sell them as registered feeds.

Whether or not the convenience to manufacturer and to consumer would outweigh the loss to the manufacturer incurred by selling as feed flour an article greatly exceeding suggested standard requirements for this article, is matter for the consideration of both parties.

BULLETIN No. 351—BAY RUM, FLORIDA WATER, Etc.

OTTAWA, November 3, 1916.

SIR,—I beg to hand you herewith a report upon 75 samples of toilet preparations, chiefly Bay Rum and Florida Water, containing alcohol.

The Inland Revenue Act, as amended in 1908, requires all preparations containing methyl alcohol to be labelled in such a way as to inform the purchaser of the fact.

"Every person who uses methyl alcohol, or spirits containing methyl alcohol in any form, in any pharmaceutical, medicinal or other preparation intended for external use shall affix to the vessel containing the said preparation a label stating, in black letters not less than one-fourth of an inch in height, the presence of methyl alcohol therein; and every person violating the provisions of this sub-section shall incur a penalty not less than fifty dollars and not exceeding two hundred dollars."

Four samples of the present collection contain methyl alcohol in violation of the Act named.

BULLETIN No. 352—EVAPORATED FRUIT AND VEGETABLES.

OTTAWA, November 16, 1916.

SIR:—I beg to hand you a report upon 180 samples purchased by our inspectors in December, January and February last, as dried or evaporated Fruit and Vegetables.

The object had in view in this inspection was the ascertainment of the content of sulphur-dioxide in this class of foods. An order in Council of 4th April, 1914, published as Circular G. 1111, limits the amount of sulphurous acid (sulphur-dioxide) which may be present in solid foods to 1 part in 2,000 parts (equivalent to 500 parts per million).

Sulphurous Acid is largely employed in the bleaching of those fruits and vegetables

in whose case it is desirable to have the product as light coloured as possible. There is, of course, a temptation to use excess of the bleaching agent; and as this is more or less poisonous, above very narrow limits, it is important that a strict watch be kept upon the articles treated with it.

Our inspectors have, unfortunately, included a large number of samples in whose case the employment of a bleaching agent is unnecessary; such as prunes, raisins, currants, etc. These samples, which of course, contain no sulphur-dioxide, I have relegated to Table II in this report, and have merely reported upon their general soundness and cleanliness. The samples included in this report may be grouped as follows:

TABLE I.

Sample in whose preparation sulphurous acid is likely to be employed as a bleach.

Evaporated Apples	35 samples.
" Apricots	18 "
" Peaches	30 "
" Pears	4 "
Total	87 "

TABLE II.

Samples in whose preparation sulphurous acid is not required as a bleach.

Tinned goods	3 samples.
Prunes	36 "
Figs	12 "
Dates	3 "
Raisins	3 "
Pineapple	1 sample.
Vegetable soups	3 samples.
Candied peel	2 "
Currants	2 "
Dried carrots	1 sample.
" peas	1 "
" potatoes	1 "
" peaches	7 samples.
" apricots	9 "
" apples	5 "
" pears	4 "
Total	93 "

In the last five kinds sulphurous acid might be present; but these are included in Table 11 because, through oversight, its determination was not made in these twenty-six samples.

So far as the 93 samples of Table I are concerned, I find as follows:

Contain no sulphurous acid	19 samples.
" no excess sulphurous acid	47 "
" slight excess sulphurous acid	3 "
" decided excess sulphurous acid	18 "
Total	87 "

Eighteen samples containing above one and one half (1·5) parts of sulphurous acid per 2,000 parts by weight, I find:—

Containing 4 parts per 2,000	1	sample.
" 3 "	5	samples.
" 2 "	8	"
" less than 2 parts	4	"
Total	18	"

It is regrettable that this report has been so long delayed, due to press of work and the fact that our staff is shorthanded. I would respectfully recommend that no action be taken upon it, partly for this reason, and partly because it is a first inspection under our standards for sulphurous acid. A further and more extended inspection will be made at as early a date as possible.

BULLETIN No. 353—TEMPERANCE BEER.

OTTAWA, November 13, 1916.

SIR,—I beg to hand you a report upon 129 samples purchased by our inspectors in February, March and April last as Temperance Beer.

An Order in Council of February 8, 1911 and published as Circular G. 947 defines Malt Liquors and Malt Beverages as follows:

"1. Malt Liquor is a beverage made by the alcoholic fermentation of an infusion in potable water, of barley malt and hops.

2. Ale or beer is a beverage produced by top fermentation of an infusion, in potable water, of barley malt and hops; with or without other starchy and saccharine matters and contains in one hundred (100) cubic centimetres (20° C.) not less than two and seventy-five one-hundredths (2·75) grammes of alcohol (equivalent to six (6) per cent by volume of proof spirits), not less than three and one half (3·5) grammes of extract, and not less than eleven one-hundredths (0·11) gramme of ash, chiefly potassium phosphate.

3. Porter and Stout are varieties of ale or beer made in part from highly roasted malt, or barley, and agree, in other respects, with the requirements for ale and beer.

4. Lager Beer, is beer produced by bottom fermentation which contains, in one hundred (100) cubic centimetres (20° C.), not less than three and one-half (3·5) grammes of extractive matter and eleven one-hundredths (0·11) gramme of ash, chiefly potassium phosphate, and not less than two and fifty hundredths (2·50) grammes of alcohol, equivalent to five and five tenths (5·5) per cent by volume, of proof spirits.

5. Light Beer, is a Beer, containing in one hundred (100) cubic centimetres, at 20° C. less than two (2) grammes of alcohol (equivalent to less than four and four-tenths (4·4) per cent by volume of proof spirits)."

It will be observed that Beer (Ale), Lager Beer and Light Beer are defined. The last named may contain up to 4·4 per cent. of proof spirits.

The article known and extensively sold as Temperance Beer, or Non-alcoholic Beer, has appeared on our markets since the enactment of the above quoted standards, and is, undoubtedly intended to meet the requirements of the Anti-Liquor Laws recently passed by several of the Provincial Legislatures.

All the above named types of Beer defined by G. 947 are spirituous liquors, and as such are debarred from sale wherever the Anti-Liquor laws are in force. Brewers have quite naturally sought to meet the popular demand for an article resembling beer, and

possessing some of the properties of beer, by placing on the market a malt product which should contain so little alcohol as to permit its sale as a non-alcoholic beverage.

In defining fruit juices and other non-alcoholic drinks, it was found necessary to recognize the fact that, as most of these beverages contain fermentable material (sugars), small quantities of alcohol must naturally be present, due to unintentional fermentation in manufacture or in storage. The actual amount of such accidental alcohol might be very small; but practical conditions of bottling, transportation and storage make it possible for the alcohol—to increase in amount, after leaving the factory, and it was necessary to ascertain, by actual analysis, the facts of the case. It may be well to introduce here a brief summary of the data upon whose study a recommendation was made by your Advisory Board.

(Alcohol is stated in terms of proof spirit)

Bulletin No. 82, published in 1902, reported 15 samples sold as Unfermented Grape Juice:

2	samples	contained	no alcohol.
9	"	"	traces only.
4	"	"	amounts varying from 1·86 per cent. to 3·30 per cent.

Bulletin No. 94, published in 1904, reported 21 samples of Sweet Cider.

1	sample	contained	no alcohol.
15	"	"	less than 1·75 per cent.
5	"	"	more than 1·75 per cent. and up to 3·85 per cent.

Bulletin No. 166, published in 1908, reported 63 samples of so-called Unfermented Grape Juice.

51	samples	contained	no alcohol, or traces only.
1	"	"	less than 1 per cent.
2	"	"	less than 2 per cent.
1	"	"	less than 3 per cent.
5	"	"	less than 4 per cent.
2	"	"	less than 5 per cent.
1	"	"	above 5 per cent.

Bulletin No. 169, published in 1908, reported 15 samples of Sweet Cider.

10	samples	contained	no alcohol or traces only.
3	"	"	less than 1 per cent.
1	"	"	1·16 per cent.
1	"	"	2·48 per cent.

Bulletin No. 239, published in 1912, reports upon 36 samples of Sweet Cider, very few of which were entirely free from alcohol.

22	samples	gave	less	than	1 per cent.
5	"	"	"	2	"
7	"	"	"	3	"
2	"	"	more	than	3 per cent.

Bulletin No. 280, published in 1914, reports 150 samples of so-called Soft Drinks. Most of these are free from more than traces of alcohol; but three samples of Ginger Beer contained over 3·50 per cent. proof spirits.

Bulletin No. 307, published in 1915, reports upon 111 samples of Unfermented Grape Juice. With few exceptions the alcohol does not exceed 3·50 per cent. (proof spirit), but scarcely any samples are entirely free from alcohol.

Experience gained since 1911 serves to strengthen my opinion that the limit fixed by Order in Council, in that year, is a reasonable one. Anything more exacting would work unnecessary hardship to manufacturers of Grape Juice, Sweet Cider, and so-called Soft Drinks.

It is of course, to be kept in mind that the number 3·5 per cent. proof spirit is a limit number, which will, under normal conditions of sale, be met with in soft drinks only at long intervals and in rare cases.

So-called "Temperance Beer" is, on the contrary, intended to be a non-alcoholic beverage only in the sense of containing not more alcohol than 3·5 per cent. while the manufacturer endeavours to work as close to this limit number as possible. It has even been urged that an occasional excess of spirit above 3·5 per cent. should not be held to constitute adulteration, since the fact that, as a rule, this class of beer contains no more than 3·5 per cent. of spirit proves the brewer's intention not to exceed this limit. Occasional excess is therefore clearly accidental and should be so regarded.

If Temperance Beer is given legal recognition—at present it has none—the above contention may be regarded as reasonable.

The report now placed in your hands concerns 129 samples sold as Temperance Beer. Of this number, 114 samples contain not more than 3·5 per cent. of proof spirit; and if the terms of the Order in Council of 8th February 1911 may be construed as applying to the article in question, these samples must be regarded as non-alcoholic beverages, under the Federal Act.

Several of the Provincial Acts fix 2·5 per cent. of proof spirit as the limit for temperance beers. Eighty-four (84) of these samples meet provincial requirements.

Fifteen (15) samples contain more than 3·5 per cent. In detail as follows:

3·71	per cent.	1	sample.
4·12	"	2	"
4·26	"	1	"
4·40	"	1	"
4·52	"	2	"
4·64	"	1	"
4·76	"	1	"
4·89	"	2	"
5·01	"	2	"
5·37	"	1	"
5·98	"	1	"

Since Temperance Beer, under which name these articles were sold, is not recognized legally, it is questionable whether or not they can be judged as adulterated under the Act. Of course if we recognize this term as defining a non-alcoholic beverage, they contravene the Order in Council of 8th February 1911, and are adulterated.

In this connection it may be well to point out that the specific gravity of the alcoholic distillate has been interpreted by reference to the Hehner Tables. These Tables have, since 1884, when a special edition of them was published by this Department and distributed for the use of its officers, been accepted as official. I have not, however, been able to find any strictly legal sanction for their use in preference to other Alcohol Tables, variously authorized, with which they do not strictly conform.

I would respectfully advise the authoritative adoption of some one set of tables; and a set recently prepared under the direction of Sir Edward Thorpe, Principal of the Government Laboratories of Great Britain, would appear to be the best available. The Tables in question have been constructed with very great care, and are based upon the latest and most exact data in existence.

It is further to be observed that under ordinary conditions of working, there is a limit to accuracy practically obtainable. Very extended work in these laboratories leads me to conclude that the fourth decimal figure of the number expressing the specific gravity of a highly diluted alcohol may, even in careful hands, vary to the extent of one unit. This corresponds to an amount of proof spirit represented by approximately two-tenths (0·2) of one per cent. and I regard it as reasonable to allow a variation of this amount in interpretation. In other words, a beverage showing 3·70 per cent. of proof spirit, as the result of analysis, should not be held to exceed the legal limit of 3·50 per cent. by an amount which could justify legal penalty.

BULLETIN No. 354—GLUTEN FLOUR, Etc.

OTTAWA, November 16, 1916.

SIR,—We have on many occasions during recent years been asked to make an examination of the cereal foods offered especially for the use of persons suffering from diabetes mellitus. These foods, of which a considerable number are on the market, are usually high priced articles; and that they should be costly in comparison with ordinary cereal foods, is but reasonable, since if they fulfil their claim to contain a high percentage of cereal proteins, and in consequence, a comparatively small percentage of starch, their manufacture necessitates the employment of a correspondingly large amount of raw material, as well as the use of skilled labour.

The wrong done to sufferers from diabetes caused by misrepresentation of the character of these foods, is very apparent; and the demand that we should require foods of the class referred to, to meet definite standards is not at all unreasonable. It is acknowledged by physicians that the use of foods containing starch or sugar (glycogenic carbohydrates) in large amount, is dangerous to persons suffering from diabetes; and the whole class of foods to which I refer is characterized by relatively low carbohydrate content. That carbohydrates should be entirely absent is neither necessary nor desirable; but the degree of toleration of carbohydrates must be determined by the physician in each individual case.

It is evident that intelligent advice can only be given when the physician is correctly informed as to the composition of the food which he prescribes. Alike, then, from the point of view of physician and patient, it is necesary that dietary foods for the diabetic should be standardized; and the name under which such foods are sold, should carry a definite meaning.

The work of the Agricultural Experiment Station at New Haven, Conn. during the past five years (see reports for 1911 to 1915) has demonstrated that many of the special foods sold for the use of diabetics, are essentially fraudulent; and national attention has been called to the matter by the excellent work done in Connecticut and elsewhere. In consequence of this, the following decision has quite recently been issued by the Department of Agriculture at Washington.

FOOD INSPECTION DECISION 160.

Gluten products and "Diabetic" Food.

The following definitions and standards for gluten products and "diabetic" food were adopted by the Joint Committee on Definitions and Standards April 9, 1915, and were approved by the Association of American Dairy, Food, and Drug Officials, August 3, 1915, and by the Association of Official Agricultural Chemists, November 17, 1915:

Ground gluten is the clean, sound product made from wheat flour by the almost complete removal of starch and contains not more than ten per cent (10%) of moisture, and, calculated on the water-free basis, not less than fourteen and two-tenths per cent (14·2%) of nitrogen, not more than fifteen per cent (15%) of nitrogen-free extract (using protein factor 5·7) and not more than five and five-tenths per cent (5·5%) of starch (as determined by the diastase method).

Gluten flour is the clean, sound product made from wheat flour by the removal of a large part of the starch and contains not more than ten per cent (10%) of moisture, and, calculated on the water-free basis, not less than seven and one-tenth per cent

(7·1%) of nitrogen, not more than fifty-six per cent (56%) of nitrogen-free extract (using the protein factor 5·7), and not more than fourty-four per cent (44%) of starch (as determined by the diastase method.)

Gluten flour, self-raising, is a gluten flour containing not more than ten per cent (10%) of moisture, and leavening agents with or without salt.

"*Diabetic food.* Although most foods may be suitable under certain conditions for the use of persons suffering from diabetes, the term "diabetic" as applied to food indicates a considerable lessening of the carbohydrates found in ordinary products of the same class, and this belief is fostered by many manufacturers on their labels and in their advertising literature.

A "diabetic" food contains not more than half as much glycogenic carbohydrates as the normal food of the same class. Any statement on the label which gives the impression that any single food in unlimited quantity is suitable for the diabetic patient is false and misleading.

The foregoing definitions and standards are adopted as a guide for the officials of this Department in enforcing the Food and Drugs Act.

D. F. HOUSTON,
Secretary of Agriculture.

WASHINGTON, D.C., January 3, 1916.

It will be noted that the terms "ground gluten" "gluten flour" and "diabetic food" are more or less closely defined. In the present state of our knowledge, I do not think it practicable to be more specific than the requirements of the Decision above quoted.

The present report concerns 21 samples purchased by our inspectors under various names, but all evidently intended for the use of sufferers from diabetes. They may be classified as follows:

Gluten flour	9	samples.
Gluten meal	3	"
Gluten bread	3	"
Diabetic bread	1	"
Diet flour	2	"
Dainty Fluffs	1	"
Gum Gluten Granules	1	"
Casoid Biscuits	1	"
Total	21	samples.

In order to apply standards effectively it should be required of manufacturers that, in addition to whatever specific name they may chose to give their product, a subtitle should be used, and legibly printed on the label, fixing the special class:—ground gluten, gluten flour or diabetic food to which the article conforms.

It will be noted that ground gluten is required to contain at least 14·2 per cent. of nitrogen (equivalent to 80·94 per cent. protein, if the factor 5·7 is used, or 88·75 per cent if the usual factor, 6·25 is used); gluten flour, 7·1 per cent. nitrogen (equivalent to 40·47 or 44·375 per cent. protein) or half the amount contained in gluten.

Diabetic foods generally, are required to contain not more than half the amount of carbohydrates that a normal food of the same class would contain.

The starch limit for gluten is fixed at 5·5 per cent. and for gluten flour at 44 per cent.

Wynter Blyth (quoted by Allen 1, 459) gives the following proteid and carbohydrate percentages for wheaten bread:—calculated on the loaf containing moisture.

	Minimum.	Maximum.	Mean for Fine bread.	Mean for Coarse bread.
Water	26·39	47·90	38·51	41 02
Proteids	4·81	8·69	6·82	6·23
Carbohydrates	39·75	67·45	49·97	48·69

The average proteids and carbohydrates in ordinary bread, calculated upon the dry material, would therefore be.

For fine bread	Proteids	11·91 per cent.
	Carbohydrates	81·26
For coarse bread	Proteids	10·56
	Carbohydrates	82·55

According to this standard, diabetic breads should not contain above about 40 per cent. of carbohydrates, calculated upon the dry material; and by a parity of reasoning they should contain at least 22 per cent. of proteids.

I have used the following numbers as a guide in interpreting the results of analysis. It must be remembered that, in the absence of legalized standards, my conclusions must be regarded as merely expressions of opinion.

Limits for

	Proteids. (Minimum).	Carbohydrates. (Maximum).
Gluten	80	6
Gluten Flour	40	45
Diabetic Breads	20	42

Three (3) samples meet the required standard for gluten, and five (5) samples meet the standard suggested for diabetic flour or bread.

The remaining thirteen (13) samples do not justify any reasonable claim to be regarded as diabetic foods.

BULLETIN No. 355—BRAN.

OTTAWA, November 17, 1916.

SIR,—I have the honour to hand you a report upon 186 samples of Bran, purchased by our inspectors throughout the Dominion in February, March and April of this year.

Standards for Bran were legalized by Order in Council in October, 1910 (G. 932) and require this article to contain at least 14 per cent of proteids and 3 per cent of fat, with not more than 10 per cent of fibre. The Feeding Stuffs Act of 1909, Section 15, provides that a deficiency of one per cent of protein or fat, or an excess of two per cent of fibre shall not be held as evidence of fraudulent intent on the part of the manufacturer, so long as the total value of the feeding stuff in nutritive materials is substantially equivalent to its guaranteed value.

I am glad to say that all of the samples now reported fulfil legal requirements in respect to nutritive value. The great majority of these samples are indeed, considerably above the minimum value required for Bran.

In reply to a Circular of inquiry (G. 1200) distributed to the milling industry in August of last year, several of the larger milling companies contended that our standards for fibre in Bran were too high. They asserted that, while for most years the fibre in Bran might not exceed 10 per cent, in exceptional years, the fibre content would exceed this limit.

Regarding this matter, the subjoined data are available.

Source of information.	Year.	No. of samples examined.	No. exceeding 10% fibre.	Mean fibre p. c.
I. R. Bulletin 116	1906	29	19	11.11
" 156	1908	27	5	8.69
" 191	1909	148	39	9.26
" 231	1912	78	8	8.60
" 254	1913	135	8	8.80
" 302	1915	187	19	9.00
Connecticut	1905	25		9.90
Massachusetts	1912	28		8.73
"	1913	57		9.48
"	1914	54		9.48
"	1915	72		9 64
Pensylvania	1913	76		9.22
"	1914	46		9.14

It is to be kept in mind that the figures just quoted were obtained by work done upon commercial samples of Bran, many of which were adulterated by addition of oat-hulls and other matters containing fibre, hence the average results are decidedly higher than would be the case had only genuine wheat-bran been included.

So far as the present inspection is concerned, 35 samples (out of 186) show more than 10 per cent of fibre. Only 8 samples exceed 11 per cent and the highest fibre found is 11.95 per cent.

Section 15 of the Feeding Stuffs Act permits an excess of two per cent (maximum of 12 per cent fibre) provided that the total value of the Bran meets requirements. The particular sample now referred to shows 14.53 per cent proteids and 5.26 per cent of fat, so that the excess of fibre is fully compensated. The great majority of these samples fall well within the 10 per cent limit.

Under these circumstances I find no reason for advising reconsideration of the fibre standard for Bran.

Although from the point of view of nutrient value all the samples herein reported meet legal requirements. Fifteen samples are found to contain more than 25 noxious weed seeds per pound. The very liberal interpretation of the Weeds Seeds Act, in virtue of which we permit 25 seeds per pound is based upon the consideration that before these seeds have a chance of germination they are passed through the digestive system of animals to whom the Bran is fed, and it is reasonable to expect that a considerable proportion of the vital seeds in the feed will in this way have their germinating power destroyed.

Experimental work on this subject done in the Maryland Experiment Station in 1908, and quoted in Bulletin No. 254 of this Department, seems to justify the limit of 25 seeds per pound as reasonable. At the same time, it is to be noted that this limit has not, up to the present, received legal recognition.

BULLETIN No. 356—ASPIRIN TABLETS.

OTTAWA, November 17, 1916.

SIR:—I beg to hand you a report upon 65 Tablets containing Aspirin analyzed in these laboratories.

Inspection of this article was made on account of complaints originating in Chicago, where Canadian made tablets were suspected to be spurious and fraudulent.

So far as the work recorded goes, it shows the Canadian made article to be of very good quality.

The tablets nominally contain 5 grains of aspirin, and the variations found are not in excess, for the most part, of normal variation for machine made tablets.

BULLETIN No. 357—CANNED TOMATOES.

OTTAWA, 23rd NOVEMBER, 1916.

SIR,—I have the honour to hand you a report upon Canned Tomatoes, as purchased by our inspectors in February, March and April of this year.

Without exception the contents of these cans proved to be sound and good; and it is evident that care had been taken to employ only fruit of good quality in their preparation.

As in the inspection of 1912 (see Bulletin No. 246) the cans in which these tomatoes are packed, represent three sizes, which may be designated as large, medium and small.

Large size, from 950 to 1,050 cubic centimetres, or approximately from 34 to 37 ounces.. .. .. .. 199 samples.
Medium size, from 850 to 875 cubic centimetres, or approximately 31 ounces.. .. .. 27 "
Small size, about 600 cubic centimetres, or approximately 21 ounces.. .. .. 6 "

The small size tins are only found in Western Canada, 1 sample having been obtained in Manitoba and 5 samples in British Columbia.

The medium size appears also to be characteristic of Western Canada, 1 sample was found in the Eastern Townships, 1 in Ontario, 6 in Alberta, and 19 in British Columbia.

The subject matter of this report represents 88 different brands of Canned Tomatoes. By far the larger number of these are put up in tins of 34 to 37 ounces capacity, usually known as two pound tins.

Of course the value furnished to the consumer is dependent upon the content of actual fruit; and while it is a matter of great difficulty to determine this with any high degree of exactness, the method employed by us is probably as satisfactory as any that could be devised.

In all of the samples now reported, the gross weight of the tin and contents has first been ascertained. The whole contents are then turned out upon a piece of cheese cloth, of known weight, spread upon a sieve of six inches diameter, and allowed to drain for approximately two hours, without pressure, or until drops fall at intervals, of more than 5 seconds. The weight of residual solids is determined either by direct weighing, or by deducting the weight of the separated water.

The following method has been tentatively recommended by the Association of Official Agricultural Chemists of the U.S.A. (See Journal, August 15, 1915, p. 185.).

"The preparation of the sample for analysis depends upon the character of the product and the determinations to be made. Samples in which only the solid or liquid portion is required should be treated as follows: Weigh the full can, open, pour off the liquid, allow the solid portion to drain for a minute, re-weigh the can and drained vegetables, then remove the solid portion and weigh the dry, empty can. The method selected for draining the vegetables is dependent upon the nature and condition of the sample. In most cases it is sufficient to cut around the cover and before turning it back allow the liquor to drain through the slit. Whenever a portion of the solid material would escape with the liquor by this procedure, drain upon a piece of cheese-cloth. From the weights thus obtained determine the percentage of liquid and solid contents."

The difficulty of defining a perfectly satisfactory method of working has delayed the adoption of regulations in the matter of Canned Tomatoes. The U.S.A., Bureau of Chemistry, under date 11 Oct. 1916 (see Service and Regulatory Announcements No. 184) makes the following statement:

"Since Circular 68 was issued, there are being produced in increasing quantities, tomato products of varying degrees of concentration. The Department is considering the adoption of a scale for testing tomato products, varying with the degree of concentration. If it is decided to adopt such a scale, public announcement will be given."

The information given by the report now handed to you, together with that supplied in Bulletin No. 246, should enable your Advisory Board to proceed intelligently in the matter of recommending action under Section 26 of the Adulteration Act, should action be considered necessary.

In order to a more convenient study of these data, I have arranged them in parallel columns with the corresponding results obtained in 1912 and published in Bulletin No. 246.

Most of the brands named are put up only in cans of large size. A small number of brands are put up only in medium and small sized cans. The following list, which includes samples inspected in 1912 as well as those now reported, shows the brands which are packed variously.

TABLE I.

Brands of Canned Tomatoes put up in tins of differing size. Inspections of 1912 and 1916.

Brand Name.	Large size.	Medium	Small.	Total.
Big	1	0	1	2
British Canadian	2	0	1	3
Canada First	7	3	1	11
E. D. S.	3	0	1	4
Fretz	1	1	0	2
Kelowna	0	1	2	3
Lynn Valley	17	1	0	18
Maple Leaf	10	2	0	12
Orchard City	3	2	0	5
Prairie	5	1	0	6
Pride Niagara Falls	1	1	0	2
Pure Food	0	1	0	1
Quaker	6	7	3	16
Red Feather	1	1	0	2
Royal City	0	2	1	3
Standard of Empire	1	2	0	3
Thistle	5	4	0	9
Totals	63	29	10	102

Mountain Crest is put up in the small size only, and the following brands, in medium size only, so far as our inspections show: viz:—

Meco, Talisman, Alamo, Bear, Bohemian, Cutting P. Co., Del Monte, Finest, Faultless, Gold Medal Malkins Best, North Star, Sunshine.

Table II.

The following table gives the weight of the contents of small size tins. This weight refers to the solids determined as already described, and is stated in ounces.

Brand.	Number of Samples.		Total.	Weight of Contents.
	1912.	1916.		
Big	1	0	1	9·5
British Canadian	0	1	1	10·0
Canada First	0	1	1	8·2
E. D. S	1	0	1	14·4
Kelowna	2	0	2	12·0*
Mountain Crest	0	1	1	10·5
Quaker	1	2	3	8·6*
Royal City	0	1	1	8·0
Totals	5	6	11	10·1*

* Mean.

Table III.

Samples contained in Medium size tins.

Brand.	Number of Samples.		Total.	Weight of Contents.
	1912.	1916.		
Alamo	1	0	1	16·9
All Gold	1	0	1	18·8
Bear	2	0	2	16·9
Bohemian	3	0	3	16·5
Canada First	2	1	3	14·6
Cutting P. Co	2	0	2	17·3*
Del Monte	0	1	1	16·6
Faultless	1	0	1	12·9
Finest	0	1	1	14·0
Fretz	0	1	1	14·5
Gold Medal	0	2	2	11·8*
Kelowna	1	0	1	20·8
Lynn Valley	1	0	1	14·8
Malkins' Best	0	2	2	11·7*
Maple Leaf	0	2	2	12·5
Meco	1	0	1	13·8
North Star	0	1	1	14·3
Orchard City	0	2	2	13·2*
Prairie	0	1	1	13·3
Pride N. Falls	0	1	1	17·8
Pure Food	0	1	1	10·6
Quaker	4	3	7	14·7*
Red Feather	0	1	1	14·2
Royal City	0	2	2	14·5
Standard of Empire	0	2	2	12·4*
Sunshine	0	1	1	13·3
Talisman	2	0	2	12·9*
Thistle	2	2	4	14·4*
Totals	23	27	50	14·7*

* Mean.

Table IV.

Samples packed in large size tins.

	Brand.	1912.	1916.	Total.	Solids (ounces.)
1	Air Ship	3	0	3	14·2*
2	Alexandra	0	2	2	14·3*
3	Anchor	0	1	1	12·5
4	Bell Cow	3	0	3	16·6*
5	Big	1	0	1	20·8
6	Bloomfield	1	0	1	20·9
7	Booths	1	0	1	19·4
8	Boulter	2	0	2	18·7*
9	Britannia	0	3	3	11·5*
10	British Canadian	0	2	2	15·1*
11	Burlington	0	1	1	15·0
12	Canada First	0	7	7	15·9*
13	Canada's Pride	2	0	2	19·8*
14	Canned Foods	0	2	2	15·7*
15	Clark	1	0	1	22·4
16	Colonist	0	1	1	14·2
17	Cottage	0	1	1	15·2
18	Crusader	0	7	7	15·4*
19	D. A. H	0	1	1	13·7
20	Degruchy	1	0	1	19·9
21	Dominion	0	1	1	13·5
22	Donalco	0	1	1	14·7
23	Dove	0	1	1	13·2
24	Dundee	0	1	1	16·5
25	E. D. S	1	2	3	16·4*
26	Edisons	0	1	1	15·5
27	Elgin	0	1	1	16·5
28	Essex	2	2	4	17·4*
29	Farmer	0	1	1	13·0
30	First Pick	0	2	2	20·9*
31	F. F. V	1	0	1	22·9
32	Fleur de lis	0	5	5	13·9*
33	Foote's Best	1	0	1	12·8
34	Frankford	0	3	3	17·6*
35	Fretz	0	1	1	18·1
36	Frontenac	0	3	3	16·2*
37	Garden City	1	1	2	17·1*
38	Gazelle	2	4	6	16·6*
39	Glenrose	2	0	2	22·0*
40	Gold	1	0	1	18·3
41	Gold Bond	0	3	3	16·1*
42	Golden West	0	1	1	16·0
43	Grand River	1	1	2	15·0*
44	Greens	0	2	2	15·0*
45	Harvest	0	4	4	16·6*
46	Harvester	1	0	1	16·4
47	Highlander	4	1	5	19·4*
48	Home Grown	1	0	1	21·6
49	Horseshoe	0	1	1	14·5
50	Hygeian	0	3	3	16·6*
51	Ice Castle	1	0	1	19·0
52	King Lake	0	1	1	15·2
53	Lasso	3	0	3	17·6*
54	Lily Vale	0	1	1	13·5
55	Lion	1	14	15	14·5*
56	Little Chief	8	21	29	15·4*
57	Log Cabin	0	6	6	15·4*
58	Lynn Valley	7	11	18	16·9*
59	Lucky Horseshoe	1	0	1	20·5
60	Maple Leaf	5	5	10	16·9*

* Mean.

Brand.	1912.	1916.	Total.	Solids (ounces.)
61 Meadow Sweet	1	0	1	19·7
62 Milden	1	0	1	20 4
63 Monarch	0	1	1	16·0
64 Northern	0	2	2	15·2
65 No Vary	0	2	2	17·7*
66 Old Arm Chair	0	5	5	14·0*
67 Old Church	0	1	1	16·3
68 Old Homestead	5	2	7	17·5*
69 Old Mill	0	1	1	16·0
70 Old Oak	0	1	1	15·2
71 Old Orchard	0	4	4	17.5*
72 Old Scout	2	0	2	17·8
73 Orchard City	1	2	3	16·6*
74 Oxford Choice	0	1	1	16·3
75 Parliament	0	2	2	12·8*
76 Peerless	2	0	2	18·0
77 Pelham	1	1	2	18·1*
78 Perfection	0	1	1	15·0
79 Pointer	1	0	1	19·0
80 Prairie	5	0	5	19 3*
81 Pride of Golden Hill	1	0	1	19·2
82 Pride of Niagara Falls	0	1	1	17·0
83 Primus	0	1	1	13·5
84 Prince Edward Pride	4	1	5	18·3*
85 Princess	1	1	2	17·7*
86 Prosperity	0	1	1	15·2
87 Prospectors	0	6	6	15·0*
88 Pure Food	1	0	1	22·3
89 Puritan	1	1	2	18·6*
90 Quaker	3	3	6	17·1*
91 Queen	0	1	1	15·5
92 Red Feather	0	1	1	14·5
93 Riverside	0	2	2	17·0*
94 Rose Hill	1	0	1	17·9
95 Royal	1	0	1	15·5
96 Sanitary	2	0	2	17·3*
97 Shield	2	0	2	17·1*
98 Standard of Empire	0	1	1	14·2
99 Star	1	0	1	19·6
100 St. Lawrence	0	2	2	14·5*
101 Sunset	1	1	2	19·1*
102 Swiss Bell	0	2	2	15·7*
103 Tartan	2	1	3	15·7*
104 Tauru	0	1	1	20·0
105 Tecumseh	5	0	5	17·9*
106 Thistle	2	3	5	16·0*
107 Three Stars	1	0	1	16·5
108 Triangle	0	1	1	13·5
109 Union	3	0	3	20·8
110 Vallee de Richelieu	0	1	1	14·5
111 Victoria	0	1	1	14·0
112 Vine	2	6	8	17·4*
113 Vulcan	0	1	1	13·5
114 White Rose	0	1	1	13·5

* Mean.

In many of the 114 brands reported in Table IV, where more than a single sample has been examined, great variability in the quantity of solids has been observed. I have selected a few of the brands—those in which at least six samples have been examined—in illustration of this variability.

TABLE V.

Name of Brand.	Total samples.	Solids (ounces).		
		Maximum.	Minimum.	Mean.
Canada First	7	16·5	15·3	15·9
Crusader	7	17·5	13·7	15·4
Gazelle	6	20·2	15·3	16·6
Lion	15	18·1	12·0	14·5
Little Chief	29	22·0	11·2	15·4
Log Cabin	6	16·0	14·5	15·4
Lynn Valley	18	23·2	14·2	16·9
Maple Leaf	10	24·3	12·3	16·9
Old Homestead	7	20·8	15·0	17·5
Prospectors	6	17·2	14·6	15·0
Quaker	6	19·6	15·0	17·1
Vine	8	22·5	14·0	17·4

The extremely large variation in amount of fruit solids contained in tins of similar size, and similar selling value, is noteworthy. If such differences are necessitated by the nature of the process of packing tomatoes, then surely there is great room for improvement in this art.

In Bulletin No. 246 I ventured to recommend that a minimum weight of fruit solids should be legalized for each size of can, and suggested the following:

For	large size cans	20	ounces.
"	medium " "	17	"
"	small " "	12·5	"

It will be seen from Table V, that the suggested maximum for large sized tins is reached by six brands only, and this only as an exception; the mean contents for these six brands being 16·6; 15·4; 16·9; 16·9; 17·5; 17·4 ounces. It may be that the suggested minimum was too high.

The whole subject demands further consideration; and it is in the belief that the facts now recorded may be helpful in enabling a just conclusion to be reached that I, would respectfully advise publication of this report as Bulletin No. 357.

BULLETIN No. 358—CASSIA.

OTTAWA, December 6, 1916.

SIR,—I beg to hand you a report upon 143 samples purchased throughout Canada by our inspectors, as Cassia.

This spice, which finds extensive sale in Canada, has never been legally defined in such a way as to fix limiting values, and to enable us to declare its genuineness or otherwise.

Cassia closely resembles the spice known as Cinnamon, and indeed may be regarded as indistinguishable from the latter, so far as retail spice trade is concerned.

Cinnamon and Cassia are the dry barks of trees which belong to the same botanic genus, Cinnamomum. Cinnamon is the bark of C. Zeylanicum, chiefly grown in Ceylon and the East Indies; Cassia is the bark of C. Cassia, chiefly grown in China

and India. The former bark is thinner, lighter in colour and exists (commercially) in smaller rolls than Cassia bark. It is sufficiently easy to distinguish the two articles, in the unground state; and there is a considerable difference in price between whole cinnamon and whole cassia. The botanical elements of the two are, however, practically identical; and, in the finely ground state, it becomes a difficult, if not an impossible thing, to discriminate between them. The darker colour of Cassia is almost the only distinctive character that remains.

Whether cassia is inferior to cinnamon for flavouring purposes, in cookery, is an open question. The general impression is that cinnamon is preferable. Its higher price is doubtless due to this preference. At the same time it is certain that much, if not most, of the ground cinnamon of commerce, is really ground cassia.

Several grinders distinctly label their goods with the word Cassia; and it is probable that the same spicemen put on the market a higher priced article under the name Cinnamon; but of this I have no conclusive proof. It is however quite certain that the spice in question is known to most domestic users as Cinnamon; while the term Cassia conveys a very vague meaning, or no meaning whatever. Throughout Quebec the article is known as Canelle, which means cinnamon as distinguished from cassia, to which belongs the term Casse, seldom mentioned except as a drug.

From an interesting paper on the subject, by H. E. Sindall, Chemist to the Meikel and Smith Spice Co. of Philadelphia (Journal Industrial and Engineering Chemistry, 1912, 590) it appears that the classification of the article as Cinnamon or Cassia in commerce depends as much upon its source as upon its chemical or physical properties.

The British Pharmacopoeia defines Cinnamon bark (Cinnamomi cortex) which is required to be free from cork or woody tissues, and to contain not more than 5 per cent ash; but Cassia is not defined by the pharmacopoeias.

So far as our experience goes, true Cinnamon, in the restricted sense, is but little if at all employed as a spice, in the ground condition.

Under these circumstances, it will be seen that a discrimination between cinnamon and cassia, as spices, is difficult to maintain. It is open to question how far we may take the darker colour of cassia, as evidence of its presence.

The difficulty of distinguishing between cinnamon and cassia, in the ground state, is recognized by the Committee of Standards at Washington, as shown by the following definitions proclaimed as legal for the United States in June, 1906.

Cinnamon is the dried bark of any species of the genus Cinnamomum, from which the outer layers may or may not have been removed.

True Cinnamon is the dried inner bark of Cinnamomum Zeylanicum, Breyne.

Cassia, is the dried bark of various species of Cinnamomum, other than Cinnamomum Zeylanicum, from which the outer layers may or may not have been removed.

Cassia buds are the dried, immature fruit of species of Cinnamomum.

Ground Cinnamon, Ground Cassia, is a powder consisting of Cinnamon, Cassia or Cassia buds, or a mixture of these species and contains not more than six (6) per cent of total ash, and not more than two (2) per cent of sand.

It will be noted that ground Cinnamon and ground Cassia are virtually recognized as identical; and this is in accord with actual experience.

The flavour of true Cinnamon is usually understood to be somewhat more delicate than that of Cassia; but on careful examination of the matter I am of opinion that the distinction has no value for purposes of a definition.

According to accessible literature, the article shipped as Cassia from China, Ceylon, Batavia and other sources, varies greatly in cleanliness; and it would seem that determination of the ash furnishes the most valuable datum in this regard. The total ash in a large number of samples reported by Sindall (Journal Industrial and Eng. Chemistry 1912, 590), representing extensive importations for the years 1908 to 1911, varied from about 3 per cent to about 13 per cent. The last quoted figure is however quite exceptional, and very few samples exceeded 7 per cent.

Six per cent appears to be a very reasonable maximum figure for a good article; and I have noted "ash excessive" in samples now reported, wherever the total ash exceeds 6 per cent or the insoluble ash (sand) exceeds 2 per cent.

Twenty two (22) samples show ash in excess of the suggested standard.

BULLETIN No. 359—TEA.

OTTAWA, December 30, 1916.

SIR,—I have the honour to submit herewith a report upon the examination of 250 samples purchased as tea. These samples represent the article as sold at retail, throughout Canada, and were purchased by the Food Inspectors of this department between April and July of the present year.

Advantage has been taken of this opportunity to make an exhaustive study of methods variously employed in ascertaining the extractive matters of tea. The importance and indeed the necessity of this investigation will be evident from the following résumé of correspondence, etc. in the matter.

The first systematic inspection of tea, under the Adulteration Act, was made in 1891, and is reported in Bulletin No. 24 of this department.

The work recorded in this report was done upon 58 samples of tea, examined by the late Professor E. B. Kenrick of Winnipeg. Professor Kenrick determined the extractive matter by what he called the Domestic Method, which he thus describes: "100 parts of boiling water are poured on 1 part of tea, and the infusion poured off at the end of 10 minutes."

His results are summarized as follows:

NATURE OF THE TEA.	TOTAL EXTRACTIVE.
Congou	23·37 per cent.
Unclassed Black	23·76 "
Average	23·56 "

NATURE OF THE TEA.	TOTAL EXTRACTIVE.
Gunpowders	28·55 per cent.
Young Hysons	34·22 "
Average	31·38 "

The Adulteration Act, Section 26, provides that the Governor in Council shall, from time to time, establish standards of quality, and fix the limits of variability permissible in any article of food.

No action has, up to this time, been taken in regard to tea, by the Department of Inland Revenue, and no standard is legally fixed under the Act named.

An Order in Council, dated 11th September, 1894, published by the Department of Customs, and apparently initiated by the Commissioner of Customs, contains the following regulations in regard to tea.

"Tea shall be considered as adulterated which contains leaves other than those of the tea-plant; or previously infused leaves or leaves of inferior quality to such an extent as to reduce the amount of extract or substances soluble in hot water to less than thirty per cent, or cause the proportion of ash soluble in hot water to be less than two and three-quarters per cent; or any admixture of chemicals or other deleterious

substances, or such an amount of mineral matter as will cause the amount of ash to exceed eight per cent reckoned on the sample dried at 100° C."

Since 1891, when Prof. Kenrick's work was published, systematic inspections of tea have been made by this department as follows:—

1904	73	samples.—	See	Bulletin	No. 99
1906	89	"	"	"	130
1909	222	"	"	"	183
1913	149	"	"	"	287

In the case of the inspection of 1913, I found myself justified in saying: "On the whole, this report may be taken to prove that there is no noteworthy adulteration of tea in Canada."

That such a state of things exists, must be largely credited to the care given by the Department of Customs, to control of importations. Instructions to Collectors of Customs were issued by the Commissioner in April 1895 (Memo. 740 B) and again in March, 1899 (Memo. No. 1035 B). The following Memo. No. 1414 B, at present governs in the matter.

No. 1414 B.

MEMORANDUM.

DEPARTMENT OF CUSTOMS, CANADA,
OTTAWA, May 31, 1907.

To Collectors of Customs:

PROHIBITION OF ADULTERATED TEAS.

The following instructions are substituted for Section 2 of Memo. No. 1035 B. of 1st March, 1899, concerning the Prohibition of Adulterated Teas:

2. Representative samples of the following classes of Imported Teas, when entered for consumption shall be sent to the Department of Customs at Ottawa to be tested, before such teas shall be released by the Collectors, viz.:—

(*a*) Representative samples of all teas from the United States not accompanied by Customs certificates of fitness for consumption in the United States.

(*b*) Representative samples of all tea dust.

(*c*) Representative samples of all teas costing twenty cents per pound or less in the country of growth, or costing when landed in Canada twenty-two cents per pound or less.

(*d*) Representative samples of all teas shipped on *consignment.*

Collectors may permit imported teas to be removed to the importers' warehouses pending test, subject to Custom control until released as fit for consumption.

JOHN MCDOUGALD,
Commissioner of Customs.

Mailed to Outports.

In a still earlier report (see Bulletin 130, p. 3) my predecessor in office made the following statement:

"On the whole it has to be stated that there is no evidence of adulteration to be found in the samples collected, although there are no doubt great variations as regards quality. This favourable showing is to be expected in view of the fact that the following clause under "Prohibited Goods" still forms part of the Customs Tariff: "1205. Tea adulterated with spurious leaf or with exhausted leaves, or containing so great an admixture of chemicals or other deleterious substances as to make it unfit for use. Nevertheless it is necessary that great care should be exercised in the inspection of teas as they arrive at the ports of entry, because, according to the report of the Prin-

cipal Chemist of Great Britain for the year ended March 31, 1906 (page 7), of the 2,917 samples (of tea) examined 259 were reported against, chiefly on account of the presence of foreign substances. It is not impossible that some of these rejected lots might find their way to Canada."

The Order in Council of 11th September, 1894 establishes the following limit numbers for tea:—

1. *Ash*—must not exceed 8 per cent by weight on the dry tea.
2. *Water Soluble Ash*—must not be less than 2·75 per cent.
3. *Extractive Matter*—must not be less than 30 per cent of the weight of the tea.

In my report of 1909 (Bulletin No. 183) I drew attention to the fact that variations in the method of working for determination of extractive matter result in great differences in the amount of extractive.

Thus, 157 samples out of 222 reported, yielded 30 per cent of extractive when treated as follows:—

To 5 grammes of the sample, ground to a tolerable degree of fineness, 200cc. of water is added, and boiled on a sand bath, in a glass flask for two hours. It is then thrown on a filter, and the residue washed 3 times with warm water. The filtrate and washings are made up to 250cc. and an aliquot portion is evaporated to dryness at 100° C.

Of 50 samples which failed to reach the standard limit of 30 per cent 31 were black teas, and 19 were green teas. It has been abundantly demonstrated that the average extractive matter in green teas is distinctly higher than in black teas, when the same method of working is employed.

Quite the most important feature of this report is the proof that changes in the method of determining extractive matter in tea so greatly affect results, that the fixing of a legal minimum of 30 per cent has no practical meaning unless the method of working for extractive is carefully defined. Four samples of tea, which yielded less than 30 per cent of extractive matter, when treated as above described, gave greatly increased yields on continued boiling.

Sample.	Extractive for 2 hours.	Extractive on longer boiling.
1	23.52	34.74
2	23.68	26.04
3	22·56	32.09
4	21.72	25.30

There can be no doubt that continuous boiling effects change in the celluloses of the tea-leaf, producing soluble bodies of the nature of pectins; and that this action goes on indefinitely; or at least for such a length of time as to make a sharply defined end point to continued solution impracticable. I pointed out the necessity of including in any definition of tea involving a minimum extractive, a description of the mode of making the extraction.

One of the largest English producers and importers of tea addressed the Secretary of the London Chamber of Commerce, under date, 20th October, 1909, as follows:—

"Dear Sir,—We should be obliged if you would call the attention of General Laurie, —Chairman of the Canadian Trade Section of the Chamber of Commerce—to Bulletin No. 183 of the Laboratory of the Inland Revenue Department, Ottawa, which contains a report by Mr. A. McGill (Chief Analyst) to the Deputy Minister of Inland Revenue on 222 samples of tea.

The wording of the report shows that he is dissatisfied with the method laid down by the Order in Council of 11th September 1894 for determining a method of analysis.

The Order in Council referred to fixed 30% as a minimum of extractive matter, without, however, defining the method by which the extractive should be made, and the Chief Analyst points out that differences in method of extraction show different results, and suggests that in consequence, there is a difficulty in deciding as to the quality of the tea. He expresses the opinion that the Order in Council should be definite in stating the exact method which the analyst should employ in order to arrive at the percentage of extractive.

This is a matter of the greatest importance to ourselves and to all firms who import tea into Canada, and at this stage we desire to express the opinion that there is no better method, or one that works more satisfactorily than that employed by H. M. Customs and which is not, we understand, governed by rigid methods. It is moreover so extremely technical that we are not capable of precisely indicating it. We may say, however, that the question of the prevention of the importation into this country of tea of very poor quality with a view to excluding all teas of a character detrimental to health or in any way adulterated was as lately as 1905 under the consideration of the then Chancellor of the Exchequer, H. M. Customs, and the London Tea Trade, and the view expressed was that the adoption of arbitrary standards based either on the chemical analysis of the product or on a definite size and make of leaf was unadvisable and tended to hamper trading conditions. This opinion was based on the personal experience of several members of the trade who had had experience of the working in the United States of America and in the Australian Commonwealth, of laws designed to exclude inferior teas; and they were, in consequence, able to point out that the adoption of arbitrary standards led to such grave dissatisfaction, that such standards had to be modified by the very experts responsible for adopting them, so as not to unduly hamper trading conditions.

There can be no doubt that the object to be attained is the provision of real protection both to the importer and to the consumer of tea—and we desire respectfully to suggest that if the Canadian Government would put themselves into communication with the London Customs Authorities and arrange for an exchange of ideas on the subject, it might be found that the method adopted by H. M. Customs in London is less complicated and more reliable than the system at present adopted by the Canadian Authorities, or any amendment of that system, such as indicated as desirable by the Chief Analyst. Indeed, we understand that the Australian Government at one time employed method similar to that now used by the Canadian Government, and abandoned it in favour of the method employed by H. M. Customs in London.

We know from previous experience the prompt attention which is paid by the Government of Canada to any representations which are endorsed by General Laurie, and for this reason we venture to ask for his valuable assistance in conveying to the Dominion Government our earnest desire that the suggestion indicated above, may receive the early and sympathetic consideration of the Deputy Minister of Inland Revenue."

In reply to enquiry as to methods in use by the London Custom House, I received the following letter from the Secretary:

CUSTOM HOUSE, LONDON, E.C.,
6th December, 1909.

SIR,—In reply to your letter of the 9th ultimo, addressed to the Right Honourable the Chancellor of the Exchequer, I am directed by the Board of Customs and Excise to inform you that the provisions governing the admission of tea into the United Kingdom are contained in the Sale of Food and Drugs Act, 1875 Sections 30 and 31, a copy of which is enclosed. It will be seen that there is no legal standard for the

percentage of extractive matter, (or other constituent) of tea; consequently no official method for the estimation of the extractive matter is prescribed.

In the ordinary course of examination of tea, however, the amount of extractive is of course taken into account by the Government Analyst, and the method employed is essentially the same as that adopted in Canada, i.e. the determination of the *total* extractive by complete exhaustion of the tea, as distinguished from the "domestic" method of partial extraction of the soluble constituents by infusion for a few minutes only.

The satisfactory results attributed to the British system of examination are probably due to the absence of any fixed analytical standards and the consequent discretion allowed to the Analyst to deal with each sample on its individual merits.

I am, sir,
Your obedient servant,

W. G. LEWIS.

The Chief Analyst,
Inland Revenue Department,
317 Queen Street,
Ottawa, Canada.

The provisions of the Sale of Food and Drugs Act, 1875, to which reference is made in the above letter, are as follows:—

Extract from the Sale of Food and Drugs Act, 1875.
38 and 39, Vict. Cap. 63.

Tea to be examined by the Customs on importation.

Sec. 30. From and after the first day of January one thousand eight hundred and seventy-six all tea imported as merchandise into and landed at any port in Great Britain or Ireland shall be subject to examination by persons to be appointed by the Commissioners of Customs, subject to the approval of the Treasury, for the inspection and analysis thereof, for which purpose samples may, when, deemed necessary by such inspectors be taken and with all convenient speed be examined by the analysts to be so appointed; and if upon such analysis the same shall be found to be mixed with other substances or exhausted tea, the same shall not be delivered unless with the sanction of the said commissioners and on such terms and conditions as they shall see fit to direct, either for home consumption or for use as ships stores or for exportation; but if on such inspection and analysis it shall appear that such tea is in the opinion of the analyst unfit for human food, the same shall be forfeited and destroyed or otherwise disposed of in such manner as the said commissioners may direct.

Interpretation of Act.

Sec. 31. Tea to which the term "exhausted" is applied in this Act shall mean and include any tea which has been deprived of its proper quality strength, or virtue by steeping, infusion, decoction or other means.

An examination of Mr. Lewis' letter, and of Sections 30 and 31 of the Sale of Food and Drugs Act, will show that the methods adopted by the London Customs Authorities, and so highly approved by importers of tea only differ from our own methods, and those sanctioned by the Canadian Customs Authorities, by being less exactly defined. The closing sentence of Mr. Lewis' letter suggests that "The satisfactory results attributed to the British system of examination are probably due to the absence of any fixed analytical standards, and the consequent discretion allowed to the Analyst to deal with each sample on its individual merits."

I think it must be conceded that this is a highly unsatisfactory state of things, considered from the consumer's standpoint. It has been shown that the extractive matter obtainable from tea may vary, for the same sample to the extent of eleven per

cent depending upon the length of time, and other conditions, of the extraction. In the absence of a strictly defined method of working, determination of extractive has no value whatever, and the fixing of a minimum value, below which the tea shall be regarded as adulterated, means nothing at all as a protection to the consumer.

Under these circumstances, it seems to me that the following points demand investigation:—

1. Is it reasonable and proper to fix a minimum limit for extractive matter in tea?
2. Should such limit be fixed without regard to the class of tea examined?
3. Under what conditions of working should determination of extractive be made?
4. What other determinations possess value in deciding as to the character of tea?

1. The value of tea is so evidently dependent upon the amount and character of the substances which it yields to hot water, that the first question appears to answer itself. The soluble matters of tea are essentially caffeine, tannin, proteins, gum, dextrin, colouring matter, mineral matter, with minute amounts of other substances.

The sophistication of tea by partial extraction, and subsequent treatment of the leaves with gum, rolling and drying, was at one time a very common practice, and doubtless obtains to some extent at the present day. The extractive matters thus obtained can be profitably employed for preparation of the alkaloid. It is apparent that the simplest way of ascertaining whether or not a sample of tea contains considerable amounts of exhausted leaves, is by determination of the extractive.

2. I have already pointed out the fact that black teas generally yield decidedly lower extractive than green teas.

The amount of extractive is affected to a considerable extent by the quality of the tea, the locality where grown, and the care taken in its preparation for market. With these differences, we are not concerned; the object had in view by the Analyst is not the grading of the tea as first or second quality; but the determination of its specific genuineness.

The following amounts of total extractive in black and green teas, are recorded by the authors named:—

Author.	Black.	Green.
Hassal (average)	33.85	41.20
Slater "	30.36	41.48
Battershall (average)	30.13	37.95
Kenrick (domestic method)	23.56	31.38
Y. Kozai (Japan teas)	47.23	53.74

While the above quoted results give speaking testimony to the need for adoption of an authoritative method for determining extractive, they prove conclusively that, no matter what method is used, black teas yield a decidedly lower extractive than green teas. This is quite in accord with our own experience.

It would seem unreasonable, on this account, to legalize the same standard for both classes of tea.

German standards for tea (Deutsches Nahrungsmittelbuch, 1909, p. 232) require at least 28 per cent extractive matter for green tea, and 24 per cent for black tea; and are the only standards known to me which recognize this difference of extractive in green and black teas.

3. The method of working for determination of extractive matters in tea employed in these laboratories, has been the following:—

(*a*) To 5 grammes of the sample, ground to a tolerable degree of fineness, 200 cc of distilled water is added, and boiled on a sand bath in a glass flask for 2 hours. It is then thrown on a filter, and the residue washed 3 times with warm water. The filtrate and washings are made up to definite volume, and an aliquot portion is evaporated to dryness at 100° C.

The Krausch method of working, recommended by the A.O.A.C. Washington (see Bull. Bureau of Chemistry No. 107, revised ,p. 147) is as follows:—

(*b*) Treat 20 grams of tea with 400cc. of water, and heat on a boiling water bath for 6 hours. Filter through a tared filter, wash with water until the filtrate measures 1000cc. Dry and weigh the residue. Determine the water soluble substance by difference.

This method is greatly modified in the latest revision of tentative standards (see Jour. A.O.A.C. Nov., 1916, p. 335) as follows:—

(*c*) To 2 grams of the original sample in a 500cc. Erlenmeyer flask add 200cc. of hot water and boil over a low flame for an hour. The flask should be closed with a rubber stopper through which passes a glass tube 18 inches long for a condenser. The loss from evaporation should be replaced from time to time by the addition of hot water. Filter through a tared filter and wash the residue until the filtrate measures 500cc. stirring the contents of the filter throughout the process to facilitate the filtering. Dry the filter paper and residue in the funnel in the steam oven until the excess of water is removed, transfer paper and contents to a tared weighing bottle and dry to constant weight at 100° C.

Allen (Organic Analysis, Vol. VI, 621) recommends the following:—

(*d*) 2 grams tea, in powder form, is boiled for 1 hour with 100cc. water. The liquid is filtered hot, and the residue again boiled with 50cc water and filtered. This process is repeated so long as any colouring matter continues to be extracted. Finally the decoction is made up to a definite volume and an aliquot portion is evaporated to dryness and weighed. As a check, the filter and contents are dried at 100° C. and the insoluble matters detached and weighed.

In all these methods, it is sought to obtain the total extractive matter. As I have already pointed out, there is a more or less considerable hydrolysis of the matters of the tea-leaf, with formation of soluble pectins, on continued boiling; and no definite end point is practically attainable. The same objection holds in the case of repeated extractions as recommended by Allen. A certain amount of colouring matter will be obtained from tea, on boiling with distilled water for an hour, even after many extractions. Wigner found in successive extractions of tea, powdered and boiled for one hour periods: (*a*) 22·90 (*b*) 8·17 (*c*) 3·75 (*d*) 1·75. Sum total, 36·57 per cent. But undoubtedly this figure could have been made 40 per cent or higher, by continued treatment of the same kind.

The methods which require filtration of the whole of the water employed in extraction are tedious, and frequently impracticable, owing to the clogging of the filter with gelatinous pectins. If a small filter be used, the operation is excessively tedious; if a large filter, there is possibility of considerable error in weighing.

The work herein tabulated comprises the results obtained by variously modifying the methods already described.

In 50 samples, representing collections in Nova Scotia, New Brunswick, Prince Edward Island and Quebec City, the method A is that described as (*a*) on page 13; method B is the Krausch method.

Mr. Forward remarks: "It was impossible to filter without heating, as some of the extractive precipitates out on cooling, and clogs the filter." He finds the first modi-

fication of the Krausch method impracticable Duplicates by method A are consistently within 0·5 per cent if conditions of filtering are the same. Extractive by method A is uniformly higher than by method B.

Forty-nine samples representing various portions of Quebec province, were worked by Mr. Valin, who used 5 grammes of tea, ground to pass through a sieve of 20 meshes per inch, with 500cc. water.

The methods employed in determination of extractive as reported herein, are essentially those already described on page 13—Slight modifications adopted by the analysts are detailed below, the letters referring to those placed at the head of the columns giving extractive in the tables.

A.—5 grammes tea, powdered to pass ¼ inch mesh; 200cc. water; boiled 1 hour; filtered at 75° C.—(Forward).

B.—20 grammes; 400cc. water; heated 6 hours—Filtrate to 1000cc. Residue is weighed.

Filtration found impossible in some cases. Duplicates not closer than 2 per cent. (Forward.)

C.—5 grammes tea, powdered to pass sieve of 20 meshes per inch; 500cc. water; boiled 2 hours; cooled; made up to 500cc.; filtered 50cc.—dried and weighed. (Valin.)

D.—Same as above; but boiled one hour only. Mr. Valin found that the amount of extractive is dependent to some extent upon the volume of the solvent. Thus:—

	Tea.	Boiled for			
		1 hr.	2 hrs.	4 hrs.	6 hrs.
Using 500 cc water.....	5 grms.	37.85	38.15	39.50	40.70
	2·5 "	.....	41.30	43.10	44.60
	1 "	43.25	.....	.....	.....

E.—Same as A but filtration at ordinary temperature of room. (Davidson.)

F.—Essentially Krausch method, and found unsatisfactory (Davidson).

G.—Krausch method, using 10 grams and 200cc. water, filtrate to 750cc.—washed with warm water.

G. (1) Krausch method—20 grms. 400cc. filtrate to 1000cc.—washed with cold water.

G. (2) As above, but 20 in 400cc.—filtrate to 1000cc.—washed with hot water. (Forster.)

Mr. Collier who worked by methods A and B says: "I have come to the conclusion that method A is by far the quickest and most reliable."

4. Determinations of moisture, tannin and caffeine are important, as serving to fix with exactness the character of a sample of tea. But these estimations cannot be regarded as of first importance in fixing the specific genuineness of the article. It is to be noted that this has no regard to the quality of tea, as dependent upon immaturity of the leaf, content of volatile oil, aroma, and other considerations which regulate market values. Tea selling at 25 cents per pound may be as truly genuine, in consisting wholly of the leaves of species of Camellia, as an article worth several dollars per pound.

For the purpose of ascertaining specific genuineness, it is usually sufficient to examine the botanical character of the leaf; while in order to detect exhaustion, facing, etc., it suffices to determine ash and extractive.

For purposes of legal definition, it suffices to consider the following:—

1. Botanical character of leaf, bud and stalk.
2. Microscopic examination for "facing", etc.
3. Total ash per cent.
4. Water soluble ash per cent.
5. Extractive; as obtained by a strictly defined method.

As regards the samples (250 in number) of the present report:—

1. No leaves, other than those of the tea plant have been found.

2. No "facing" of the leaves is reported as having been verified by the microscope.

3. The total ash varies from 5 per cent to 7·68 per cent.

In greater detail:—

From 5·00	to 5·50	per cent	43 samples.
" 5·50	" 6·00	"	115 "
" 6·00	" 6·50	"	70 "
" 6·50	" 7·00	"	16 "
Above 7		per cent	4 "

4. Water soluble Ash:—

Above	4	per cent	17 samples.
"	3·5	"	121 "
"	3·0	"	97 "
"	2·5	"	13 "
Below	2·5	"	none.

5. Extractive.

On account of the variety of methods employed in determining extractive, it is impossible to summarize results.

It may be noted however, that the great majority of samples treated by method A, or its modifications, yield from 35 to 40 per cent extractive.

There is observed a difference of about 3 to 4 per cent between green and black teas, worked by this process.

The only samples yielding less than 30 per cent extractive, are the following:—

——	Ash.		Extractive mean.
	Total.	Soluble.	
No. 56732 (black)	6.33	2.57	24.46
No. 4335 (black)	6.40	2.60	25.70
No. 67868	6.48	2.82	23.60
No. 67347	6 30	2.72	24.80
No. 73144 (black)	6.64	3.28	26.19
No. 73147 (black)	5.80	3.10	26.49
No. 72845 (black)	5.80	2.66	24.22
No. 71830	5.82	3.28	27.45

These are all very low grade teas; and, in the event of standards being established under Section 26 of the Adulteration Act, I have no doubt that they would be found adulterated.

The necessity of legalizing standards for tea is self-evident. Without them Canada is likely to become a dumping ground for tea unable to find a market elsewhere.

BULLETIN No. 360—BAKING POWDER.

OTTAWA, January 17, 1917.

SIR,—I beg to hand you a report upon 213 samples of Baking Powders, purchased by our inspectors during the period, June to August of last year.

This important food material has been made the subject of systematic inspection on five different occasions before the present; and was last reported in March 1915. (Bulletin No. 308.)

The main reason for the present report is the desire to establish a standard for available gas, below which amount the article shall be held illegal. Apart from considerations of the wholesomeness of the ingredients and the harmlessness of the residues left in the bread, it is evident that the gas-producing power of baking powder is its most important character. An article which has been so badly made, or which has so much deteriorated through prolonged keeping, as to be incapable of yielding a reasonable volume of gas, is necessarily disappointing to the baker, and, beyond fixed limits, which should be legally defined, must be regarded as fraudulent.

The generally accepted and what may be regarded as the normal baking powder is expected to yield from 12 to 13 per cent. of gas (weight) when freshly made. The nature of Cream Tartar, which was the original acid ingredient of baking powders, doubtless determined this figure, which has been so long, and so widely accepted that any considerable departure from it would be confusing to the baker. (Bull. 308, p. 4.) Although burnt alum and other acid components which have more recently come into use in baking powders, are capable of producing a much higher percentage of gas, they have usually been reduced in strength by addition of starch or other neutral material so as to conform to the strength of Cream of Tartar.

The nature of a mixture of bicarbonate of soda with any acid substance is such that gradual interaction of the components must occur on prolonged keeping; and unless kept very dry and cool, this interaction may be quite rapid, and must result in the loss of so considerable an amount of gas as to render the article valueless for baking purposes.

The States of Florida, North Dakota and, I believe, some others as well as the Government of Western Australia (Gazette, July 17, 1914) have fixed 10 per cent of gas as the minimum limit for a legal Baking Powder. The following tabulation of results obtained by this Department is of interest:

Date of Inspection.	Number of Samples in which CO_2 Determined.	Average Gas p.c.
1889	149	8·17
1900	156	9·80
1908	158	10·24
1911	150	11·00
1914	251	11·31
1915	195	11·91

The averages quoted include, of course, a certain number of samples whose content of gas fell short of 10 per cent; nevertheless the means found are well above this limit, and show continuous improvement in the quality of baking powder, from the point of view of gas production.

Details of gas producing power for the last two inspections are of interest:

Available Gas.			Inspection of 1915.	Inspection of 1916.
Above	13	per cent.	48	53
"	12	"	52	56
"	11	"	62	51
"	10	"	45	13
"	9	"	12	6
"	8	"	15	6
"	7	"	5	4
"	6	"	5	4
Below	6	"	7	2
	Total		251	195

It will be seen that 82 per cent. of the collection of 1915 and 88 per cent. of that of 1916, yielded more than 10 per cent. of gas. I am of opinion that 10 per cent. of available gas is a reasonable limit, below which a baking powder should be regarded as illegal.

It is however to be noted as important that a well defined method of working should be employed in estimating available gas. This is necessary because of the very difficult solubility of burnt alum, and because of the slow decomposition of bi-carbonate of soda at a boiling temperature, quite apart from the reaction of this salt with the acid ingredient of the powder. Bi-carbonate of soda is usually present in slight excess of the amount required to neutralize the free acid of the sample. Macara (Analyst, 1915, p. 272) has shown that this reaction, on sufficiently prolonged boiling, may go on until the sesqui-carbonate is formed; in other words, until 25 per cent. of the carbonic acid in bi-carbonate is driven off.

As already stated, the question of method has been especially studied, during the progress of the work herein reported. Three general types may be noted:

1st. Methods involving the absorption of liberated gas by soda-lime or by solution of potash (gravimetric.)

2nd. Methods involving the absorption of the gas in measured excess of soda or barium hydrate solutions, and subsequent titration of the excess of absorbent (volumetric.)

3rd. Collection of the evolved gas over saturated solution of common salt, and measurement at definite temperature and pressure (gasometric.)

The effect of prolonged boiling; ratio of weight of sample to volume of solvent, and other points, have also been studied.

As the result of our investigations the following method of determining available gas in Baking Powders is recommended.

From 1 to 2 grams of the sample is used; this is boiled with about 100cc. water for 10 minutes from the time when boiling begins; with aspiration of a slow current of air which carries the liberated gas through a series of U tubes, etc., arranged as follows:—

1. A short Liebig condenser, arranged so as to return the condensed steam to the boiling flask.

2. A U tube (or tower) containing pumice saturated with strong sulphuric acid.

3. A smaller U tube containing fragments of pumice saturated with strong sulphuric acid; or lumps of fused calcium chloride, which must be neutral.

4. A U tube containing soda-lime or Liebig bulbs containing 30 per cent. soda solution.

5. Duplicate of (4.)

6. A U tube like (3.)

7. Same as (6) and connected at exit end to an aspirator or suction pump.

(A T tube should be interposed between the exit end of number 7 and the suction. The third leg of the T tube carries a piece of rubber tubing and a pinch cock. The

suction may then be turned on full, and the rate of the air current regulated by the pinch cock.)

U tubes 3, 4, 5 and 6 are weighed. Number 3 should not materially gain weight, and serves to protect 4 and 5. The increase in weight should be almost entirely confined to No. 4. When No. 5 begins to show notable increase in weight, No. 4 should be freshly charged.

After 10 minutes boiling the heat is turned off, but aspiration is continued for 20 minutes longer.

The decomposition flask may be charged with the sample and the water added through a funnel tube reaching nearly to the bottom of the flask; or, more conveniently by first charging with water, and dropping in the sample, wrapped in tissue paper immediately replacing the rubber cork which carries the funnel tube and the exit tube.

The air aspirated through the apparatus may be freed from carbonic acid by a soda lime tube, above the funnel tube. This precaution is not usually necessary, the error due to atmospheric CO_2 being so small as to be negligible. It is also desirable to have an absorption bottle immediately before the suction tube in order to observe conveniently the rate of the air current. A negative pressure must be maintained during the whole operation; but the rate of flow of air should not exceed three bubbles per second.

The source of the leavening gas, is always bi-carbonate of soda. The acid component, by which the gas is liberated, is Tartaric acid, either free or as Cream of Tartar; Sulphuric acid, as one or other of the dessicated alums, (usually soda alum) or Phosphoric acid, employed as Acid phosphate of lime, or as acid phosphate of soda. Sometimes mixtures of these are found, and, very commonly, alum and acid phosphate of lime are found together.

I think it desirable that manufacturers of Baking Powder should be required to state, on the label, the acid component used. The consumer has a right to this information, as also has the physician. Although investigation by a Board of experts of recognized competency (see Bull. No. 103, Department of Agriculture, Washington; or, Bulletin No. 308 of the Inland Revenue Department, Ottawa, p. 6) has shown that "When aluminium compounds are mixed or packed with a food, the quality or strength of said food, has not been found to be thereby reduced, lowered, or injuriously affected," many physicians, and a very large number of laymen are far from convinced that the continuous use of alum is without harmful effect upon the health. Indeed the report above referred to contains the following: "Aluminium compounds when added to foods in the form of baking powders, usually provoke catharsis. This action of aluminium baking powders is due to the sodium sulphate which results from the reaction." The inhibitive effect of alum upon gastric digestion is well established (Bulletin No. 68, Inland Revenue Department) and the great insolubility of dessicated alum compels the inference that alum as such, remains in the bread, in all cases where an alum baking powder has been used.

Albumen in Baking Powders.

The addition of albumen to a baking powder would evidently increase its value, provided that the amount of albumen added was at all considerable. As a matter of fact, albumen to the amount of about $^{15}/_{100}$ of 1 per cent. of the weight of the powder has been found in some baking powders. It is inconceivable that such an addition can have any appreciable value, as rendering the article superior in baking. It is contended that the true reason for this addition of albumen is found in the fact that, on adding water to such a powder, the increased viscosity causes a persistent froth to be formed, and thus furnishes the vendor with a means of demonstrating apparent superiority, in comparison with other powders, which do not contain albumen. Of course such a use of the article is plainly for purposes of fraud; and several States of the

American Union have forbidden the addition of albumen to baking powders, because of the fraudulent use of what is called the "Cold Water test" or "Water glass test" and the fact that the amount of albumen is so small as to possess no tangible value. It is scarcely necessary to add that, albumen being in itself a desirable food product, we cannot under the Adulteration Act, forbid its addition to Baking Powders. No intelligent buyer will permit himself to be deceived by the water glass test; and should actual deception be practiced, anyone has recourse under the common law.

Egg-Substitutes.

These are, for the most part, merely baking powders, to which has been added wheat flour rich in gluten; casein, or other proteid matter, and a yellow dye. This last is used to simulate egg-yolk; and possibly to deceive the purchaser into a belief that egg is present in the article.

The Government of Western Australia has legislated as follows: "The word 'egg' and expressions or devices which imply or suggest the presence of egg, or the equivalent of egg, shall not be written on, or attached to any package which contains baking powder." Gazette, 17 July, 1914.

I regard this action as right and proper. The high price of eggs tempts the baker to purchase anything that promises to be a substitute; and in this way, an article of little cost and of less value, is able to secure sale at an exorbitant price. The artificial colouring of a so-called egg powder, so as to make it resemble egg-yolk, should be forbidden by law.

Another class of egg-substitutes, not containing gas producing components is found on the market. For the most part, these articles consist of casein, with flour, some fat and a little sugar, coloured with a yellow dye. Fancy names like Egg-o-let, sub-egg-o, etc., have been coined for some of them. In all such articles, a plain statement of composition should be required on the label; and the employment of a dye should be forbidden.

It is hoped that this report will supply data upon which to establish standards for Baking Powder under the sanction of Section 26 of the Adulteration Act.

BULLETIN No. 361—PREPARED MUSTARD.

Ottawa, January 19, 1917.

Sir,—I beg to hand you a report upon 124 samples of so-called Prepared Mustard purchased by our inspectors during the period April to July of last year.

This inspection was ordered consequent upon representations made to the Department to the effect that adulteration of the article was largely practised by manufacturers who use starch, turmeric and pepper instead of mustard.

It must be noted here that standards for the article known as Prepared Mustard have not been legalized in Canada. We have found it impossible, up to the present, to define Mustard itself; due to conflicting evidence as regards charlock or so-called wild mustard. It is expected that standards regarding Mustard will shortly be submitted by your advisory Board.

Prepared Mustard clearly implies the presence of Mustard. What else it may imply, is not so clear.

The name Mustard indicates that this spice was used originally as a condiment by mixing the seeds with unfermented wine (*Latin, Mustum*) and so-called *German Mustard* is to this day prepared with Rhine wine, or tarragon, vinegar, spices, etc., while *French Mustard* is prepared with salt, vinegar, spices, etc. (Webster's dictionary). It is quite apparent that so-called Prepared Mustard is merely a condiment,ready for use, and having Mustard as its most characteristic component. There are probably as many formulas for the preparation of the article, as there are manufacturers of it.

It would, of course, be possible to forbid the use of certain substances in the manufacture of prepared mustard; or even to legalize a fixed formula for the article. Unless, however, the forbidden articles were shown to be unwholesome, or added for purposes of fraud, such interference with trade, would, in my opinion, be entirely foreign to the intention of the Adulteration Act. So long as only sound materials of a wholesome kind are employed; and mustard is used as the chief ingredient, I think that a free hand should be given to manufacturers. Competition, and the discrimination of the public, must decide the question of superiority.

As in the case of all foods, it must be understood that no false claims appear on the label. It would seem reasonable to expect an honourable rivalry among manufacturers for the production of the most satisfactory condiment, having mustard as a base; the crux of the claim being not so much that the article is prepared mustard, as that it is Brown's, Jones' or Robertson's prepared mustard.

Tentative Standards, published as Circular 19, June 26, 1906, by the Department of Agriculture, Washington, define *Prepared Mustard* as follows:—

"Prepared mustard, German mustard, French mustard, mustard paste, is a paste composed of a mixture of ground mustard seed or mustard flour with salt spices and vinegar, and calculated free from water, fat and salt, contains not more than 24 per cent of carbohydrates calculated as starch, determined according to the official methods; not more than 12 per cent of crude fibre nor less than 35 per cent of protein, derived solely from the materials named."

The total proteids of mustard flour may be taken as about 30 per cent. (Allen Org. Analysis, 4th edition, vii, 107). Based on this figure, the above requirements for Prepared Mustard demand that the whole of the dry material of prepared mustard free from fat and salt, shall consist of mustard flour, or equivalent protein containing spice, thus excluding starch altogether. It is therefore difficult to see why any mention of carbohydrates is made.

I am not aware of any decisions by the Courts which establish the validity of the above standard. A case is reported (U.S.A. Notice of Judgment, No. 1552) in which misbranding was alleged because wild mustard (charlock) was substituted for the usual product, and turmeric was present without declaration on the label. A verdict of not guilty was rendered.

The question of recognizing charlock as a condimental mustard cannot be considered here. It will be discussed in our next report upon mustard.

An interesting paper by Barnard & Bishop, dealing with Prepared Mustard was read before the American Association of Food, Dairy and Drug Officials at Seattle in 1912. Of 32 samples analysed 17 failed to meet the requirements of the above suggested standard, 10 contained excess carbohydrates, 2 an excess of crude fibre, and 4 samples were too low in protein.

The authors suggest a minimum of 15 per cent solids, exclusive of salt, as a desirable additional requirement, thus preventing "infinite dilution" of the article. It seems to me undesirable that our standards should take into account any constants

regarding which the ordinary consumer is as well informed, and as competent to judge, as the analyst, and it is open to question whether this is not the case with the degree of dilution of a prepared mustard.

Forty-four samples herein reported have been examined in such a way as to enable me to state the percentage of solids, other than salt and fat. These show as follows:—

No.	Solids (less salt and fat).	Starch.	Difference (mustard).	Salt.	Fat.	Carbohydrates p.c. on solids, less salt and fat.
54294	23·58	12·60	10·98	0·23	0·79	53·4
69495	23·23	11·86	11·37	0·30	1·05	50·3
†69445	18·85	10·93	7·92	0·56	3·59	58 0
71869	11·85	2·32	9·53	2·67	3·76	19·5
*69441	18·04	9·80	8·24	1·33	1·28	54 2
52457	8·88	1·61	7·27	2·74	0·92	18·1
71579	8·06	1·61	6·45	2·72	1·64	19·9
71842	8·86	2·25	6·61	1·74	2·10	25·4
69493	8·71	2·07	6·64	3·21	1·16	23·8
69492	8·58	2·23	6·35	3·40	1·10	25·9
73222	8·44	1·81	6·63	1·61	1 61	21·4
69443	7·09	1·61	5·48	2·46	1·65	22 7
52460	15·37	7·03	8·34	2·31	1·94	45·7
52459	14·36	7·18	7·18	2·26	4 00	50·0
71841	14·33	2·81	11·52	2·97	5·66	19 6
54292	14·37	2 82	11 55	1·52	7·39	19·6
73226	13·79	2·70	11·09	2·50	6·66	19·5
69491	13·12	2·61	10·51	2·27	6·59	19·8
52461	13·89	3·20	10 69	2·72	7·34	23·0
69494	13·55	2·49	11·06	1·42	1·23	18·3
52458	12·96	2·36	10·60	3·42	6·22	18·2
4974	12·60	4·55	8·05	1·75	2·17	36·1
71840	11·00	2·24	8·76	3·16	3·74	29 5
56741	12·17	3·66	8 51	1·68	3·66	30·0
56743	11·86	3·85	8·01	1·85	4·09	32·4
54295	11·89	2·81	9·08	1·08	4 95	23·6
54291	10·77	2·29	8·48	1·01	1·64	21·3
54293	10·38	2·39	7·99	0·09	2·69	25·0
71571	10·70	2·32	8·38	0 82	3·26	21·6
73225	9·05	0·24	8·81	1·47	1·60	2·6
73223	10·28	2·29	7·99	1·42	2·12	22·2
73224	9·81	2·00	7·81	1·94	2·42	20·3
4969	9·49	2 44	7·05	0·77	1·90	25·7
69441	10·84	2·43	8·41	0·98	1·42	22·4
71592	10·77	2·67	8·10	2 35	2·72	24·7
4960	9·81	2·23	7·58	2·86	3·26	22·7
69442	5·55	2·04	3·51	2·27	0·58	36·7
71838	9·33	1·94	7·39	2·15	1·26	20·7
71574	7·59	1·49	6·10	0·65	1·06	19·6
71594	8·48	1·91	6·57	2·12	3·22	22·5
56745	8·61	1·89	6·72	1·80	2·12	21 9
56744	7·97	1·89	6·08	2·20	1·88	23·7
4978	7·80	2·01	5·79	1·82	2·19	25·7
56742	10·86	3·31	7·55	1·80	3·49	30·4

†Sold as mustard cream. *Sold as salad dressing.

Examination of the above shows that manufacturers differ among themselves as to composition of a satisfactory prepared mustard. No harmful ingredients have been found in any of these samples; and I have no doubt that, as in the case of condimentary sauces, some preparations appeal to one section of the public, and some to another. An article which finds no favour with the public, will cease to be manufactured. Within the limits above named the public must judge for itself among the many varieties of Prepared Mustard offered.

Except by insisting that preparations advertised as containing mustard shall actually contain this article I do not see that any regulations or restrictions governing the matter can be justified.

BULLETIN No. 362—GASOLINE.

OTTAWA, January 23, 1917.

SIR,—The matter of inspection of gasoline has been repeatedly brought before the Department in recent years. I would specially refer to your Files of the following numbers:—

January 8, 1914..	L. 112657 of F. 105594
April 27, 1914..	L. 116577 of F. 106155
October 23, 1915	L. 135806
November 16, 1915...	L. 136753
April 17, 1916..	L. 143678
May 15, 1916..	L. 145057 of F. 110804

In reply to L 135806 I furnished you with a memorandum dated October 28, 1915, in which I supplied general information upon the subject of gasoline that may be quoted here as an introduction to the matter of this report.

Gasoline.—I have examined, so far as possible, the history of this term, and of the article signified by it, since the year 1880, when I find it used by *Arthur Burgman* in his work on "*Petroleum und Erdwachs.*" He gives the density as from 0·6667 to 0·6829, and does not quote any limits for boiling points.

Prof. Hans Hofer (1888) in "Das Erdol" quotes density from 0·640 to 0·667, and B.P. from 70° to 80°C (=158° to 176° Fah.)

Dr. Alex. Veith (1892) in "Das Erdol," gives the terms gasoline, canadol and petroleum benzine for a product of density 0·660 to 0·680, and B.P. from 50° to 70° C. (=122° to 158° Fah.)

Dr. W. Scheithauer, (1895), in "Fabrikattion der Mineralole," quotes naphtha from Shale as of density 0·700 to 0·715, and calls it raw gasoline; from this, a gasoline of density 0·640 to 0·660 is obtained by rectification.

The above are German sources of information. Further, and fairly complete details as regards petroleum generally, are obtained from Redwood's comprehensive work "Petroleum," 2 vols., 1906; and from Tinkler and Challenger's "Chemistry of Petroleum," 1915.

From the first named it appears that the fractions of crude oil (petroleum) which distil below the minimum temperature fixed for a product (Kerosene, coal oil, etc.) available for use in lamps having a wick, and very generally employed in domestic lighting, have been classed as gasoline, without any definite discrimination, for the most part.

In the early history of the refining of crude oil, these fractions had little commercial value, and were either rejected or used to furnish fuel for the stills. The minimum limit for safe burning oil is very different for different countries, and at different times. The so-called "flash test" is merely a simple way of ascertaining the boiling point of the lowest (most volatile) component of a mineral oil; and the test is made either *open* or *closed;* the latter method requiring the use of the Abel apparatus, or some similar one, the former being made in an open, saucer-shaped dish. It goes without saying that the closed test is to be preferred, wherever practicable. The so-called *fire-test* is sometimes applied, and aims at determination of the temperature at which the oil, once lighted in the open, continues to burn.

Redwood quotes the minimum limit for a great many European and American ports of entry, and it ranges variously from 70° Fah. to 110° Fah. For Canada it is 85° Fah.

Tinkler and Challenger quote the following trade names for fractions which older classifications recognize as *gasoline,* or did not accurately define at all.

Benzine.—A fraction having B.P. 70° to 120° C. (=158° to 248° Fah.) chiefly Heptane.

Benzoline.—The more volatile portion obtained on redistilling benzine; B.P. about 70° to 95° C (=158° to 203° Fah.)

Gasoline.—That fraction of B.P. 40° to 70° C. (104° to 158° Fah.) obtained in the refining of Pennsylvania oil. Consists largely of pentane and hexane.

Motor spirit.—The saturated aliphatic hydrocarbons of American oil; the polymethylenes from baku oil, or the saturated hydrocarbons derived from shale oil, as well as benzine (C_6H_6) and alcohol (C_2H_5OH) are employed in internal combustion engines. The boiling points are usually below 120° C. (=240° Fah).

Naphtha.—The less volatile portion obtained on redistilling benzine. Boils from about 95° to 120° C. (=203° to 248° Fah.). The term is unfortunately very loosely applied, and is synonymous with mineral naphtha.

Petrol.—Same as light petroleum, or benzine.

Petroleum ether.—Same as gasolene or benzine.

Petroleum naphtha.—Loosely employed; often denotes the first fraction (B.P. up to 150° C. 302° Fah.) obtained on distillation of crude oil. Often applied to any low boiling petroleum product.

Petroleum spirit and light petroleum.—Benzine, benzoline and naphtha, all of which terms are more or less synonymous.

Rhigoline.—The most volatile liquid fraction obtained in the refining of crude petroleum. B. P. 18° C. (=64·4° Fah.). Used as a local anaesthetic. Consists largely of pentane.

Shale naphtha.—Shale spirit; the lower boiling fractions obtained in the refining of crude shale oil. Sp. Grav. 0·70 to 0·76. Used as a motor spirit. Contains about 50 to 60 per cent of unsaturated hydrocarbons.

Sherwood oil.—Same as light petroleum and petroleum ether.

Solene.—Synonymous with gasoline and petroleum ether.

It is sufficiently obvious from the foregoing, that the term *gasoline,* and its equivalents, is employed with much vagueness. It is much to be desired that the term should be defined by legal enactment; since it has come into very general use, and without such definition, it is impossible to protect the public by any regulations which the government may desire to ordain for such purpose. The necessity of having such regulations, and enforcing them is apparent when we consider the great number of melancholy accidents involving life and property that are chronicled in the daily papers.

It will be noted that all of the above definitions refer to gasoline as a more or less volatile fraction of crude oil, obtained in the progressive distillation of the latter. This was true of gasoline as known in the early days of oil refining. It is not true to-day.

So long as the fraction in demand by the public, was that known as coal oil or kerosene, and designed for domestic use in lamps and stoves, the refiner found difficulty in obtaining a market for light-boiling fractions. These were chiefly used for making so-called "air gas", or for carburetting water-gas or were burned under the stills. When however, the use of internal combustion engines in motor-boats, motor-

cars, and for a multitude of other purposes, came about, the demand for these light-boiling fractions became very great, and today the refiner realizes that gasoline is the most profitable product.

This has resulted in the discovery that the heavier hydrocarbons can be broken down, by appropriate methods (cracking) and, in this way, a gasoline can be produced which is very different from the older article bearing that name. The term *saturated* hydrocarbon has appeared more than once in these definitions. Briefly, it means a hydrocarbon in which the ratio of Hydrogen to Carbon atoms in the molecule is represented by the expression CnH2n+2 where C stands for a carbon atom, and H for a hydrogen atom.

Crude petroleum is, generally speaking, a mixture of such hydrocarbons, in which n has values ranging from 4 to 35 or even higher. Crude oils differ very greatly in the proportions in which they contain these hydrocarbons, some having large percentages of the lower members of the series; others having very small proportions of the lower members. The boiling point (volatility) constantly increases as we ascend the series; and it may be interesting to quote the following:

Formula.	Name.	B.P. (Fah.)	Density.
C_4H_{10}	Butane	31·8°	0·600
C_5H_{12}	Pentane	79·3°	0.627
C_6H_{14}	Hexane	156·0°	0·658
C_7H_{16}	Heptane	209·1°	0·683
C_8H_{18}	Octane	257·9°	0·702
C_9H_{20}	Nonane	301·1°	0·718
$C_{10}H_{22}$	Decane	364·2°	0·730

Pentane and Hexane are the chief components of the older gasolines. The succeeding members of the series beginning with nonane are the chief components of well-refined coal oil (Kerosene) which is usually defined as that fraction of crude oil which boils between 150° and 300° C. (=302° to 572° Fah.) containing therefore, the hydrocarbons from nonane to hentria—contane C31H64 with B.P. 575.6 Fah.

Another series of hydrocarbons many of whose members are available for lighting, or for use as gasoline, has the general formula CnH2n. It will be noted that the molecule of this series (known as olefines, in contradistinction to the first series, which are called paraffins) has relatively less hydrogen; or stated otherwise, has relatively more carbon. Its members, for this reason, tend to burn with a sooty, or smoky flame, and are on this account, less desirable for use in internal combustion engines. The boiling points of some olefines may be noted, as below:=

Formula.	Name.	B.P. (Fah.)
C_5H_{10}	Amylene	102·2°
C_6H_{12}	Hexylene	154·4
C_7H_{14}	Heptylene	208·4
C_8H_{16}	Octylene	255·2
C_9H_{18}	Nonylene	307·4

If we assume that it is not desirable in a motor gasolene to have a higher boiling point than 200° F., and that in a coal oil for domestic use it is not desirable to have a lower boiling point than 300° F. we see that, of the paraffin series, Heptane (B.P. 209·1°) marks the limit for gasoline; while in the olefine series Heptylene marks this limit; also for domestic coal oil, nothing below Nonane can be permitted in the paraffin series, or below Nonylene in the olefine series.

It is possible, by the process known as "cracking" to change the higher members of the paraffin series into lower members, with simultaneous production of an olefine. Thus, the hydrocarbon $C_{12}H_{26}$ may be resolved into the paraffin C_6H_{14} and the olefine C_6H_{12}, both of which are available as components of gasoline, although the hydrocarbon Dodecane ($C_{12}H_{26}$) with a boiling point of 418·1° Fah. would not be thus available. This last is a normal component of coal oil. If the refiner can make a greater profit by converting dodecane into hexane and hexylene and selling is as gasoline, he will be tempted to "crack" the hydrocarbon, instead of selling it as coal-oil (kerosene).

Unfortunately, the operation of cracking does not always proceed, in practice, as the above assumptions would indicate. Under varying pressures and temperatures the hydrocarbon $C_{12}H_{26}$ may crack in any of the following ways:—

Paraffin.		Paraffin.		Olefine.
$C_{12}H_{26}$		C_6H_{14}	+	C_6H_{12}
or		C_5H_{12}	+	C_7H_{14}
or		C_4H_{10}	+	C_8H_{16}

Should the cracking result in the formation, even to a slight extent, of either C_5H_{12} (pentane, B.P. 79·3°) or C_4H_{10} (butane) (B.P. 31·8°), it will be seen that very volatile substances are produced, and these, even when small percentages only are present, render the total product exceedingly dangerous in transport or in storage or in use. The safety of the public demands that these extremely dangerous components of gasoline, as manufactured by the cracking process, should be removed from the final product before this is permitted to be placed on the market. This might be done by blowing air through it, until volatilization of the dangerous components of gasoline, as manufactured by the cracking process, should be removed from the final product before this is permitted to be placed on the market. Of course this would entail shrinkage of volume, and an apparent loss to the producer; and for these reasons, is not done; or is done very imperfectly. It is for this reason that such large losses in transportation occur as are quoted by Mr. Henderson, who asserts that a tank car may lose from 100 gallons to 300 gallons in a ten day's journey.

A modification of the "cracking" process has recently been patented, and is, I believe, being worked somewhere in New Jersey. This depends upon the catalytic action of aluminium chloride, and may prove a rival of the older processes, although that has yet to be demonstrated.

SUGGESTIONS.

I do not think that the specific gravity of a sample of gasoline gives any information of value, concerning its safety. This is much better ascertained by determining the volatility of the article; which, as regards the less volatile grades, might be ascertained by a flash test, employing a specially designed apparatus.

A still better way might be to determine the loss of volume produced by causing a current of air of known temperature and volume to bubble through a column, of definite length, of the liquid to be tested. In order to the intelligent application of this test, and interpretation of its results, considerable investigatory work would be necessary.

Should you desire such investigation to be made in these laboratories, I shall be pleased to undertake the work, on receiving your instructions.

The above quoted memorandum presents, in a general way, the main features of gasoline production; but by no means covers the subject completely. Particularly should be mentioned the fact that the cracking process results in the formation of varying amounts of hydrocarbon products other than paraffins and olefines. These may include various members of the benzene series (aromatic hydrocarbons); and considerable amounts of benzene, toluene and xylene may be obtained from certain crude oils, by variously modifying the conditions of the cracking process.

It may also be noted that so-called casing-head gasoline is obtained from certain varieties of natural gas by compression and condensation, or by washing the gas with heavy oils and subsequent separation of the gasoline by distillation. Naturally this variety of gasoline is extremely volatile, and is employed for blending purposes.

Anyone interested in the further study of this aspect of the matter is referred to Bulletin No. 114 of the Bureau of Mines, Washington, D.C.

In March 1914 I addressed a circular letter to several of the larger users of motor gasoline, including the railway companies, in order to ascertain whether or not they purchased to specification. Replies indicate that usually no specification is submitted with call for tenders; and that, in cases where requirements are defined, the specific gravity of the article is the only consideration.

I have already stated my opinion that specific gravity alone, furnishes very imperfect information regarding a sample of gasoline. This is apparent when we consider that most, if not all, of the gasolines on the market, are mixtures of fractional distillates of widely varying density; and it is an easy thing for the producer to make choice of such components as shall produce a complex of any desired specific gravity.

It is usual to express the density of gasoline in degrees Baume: a method which should be obsolete. To convert degrees Baume, for liquids lighter than water, the following formula may be used.

$$\text{Spec. Grav.} = \frac{\text{Modulus}}{(\text{Modulus} - 10) + \text{degrees B.}}$$

The modulus generally employed is 140; but is not constant. The U.S.A. Bureau of Standards has approved 140.

In order to ascertain whether or not the brand name under which the article is sold, means uniformity of character, I tabulate below the results of analysis of 21 samples purchased by our inspectors as Premier; 9 samples purchased as White Rose; 6 samples purchased as Peerless, and 3 samples as British Motor.

In each series, the samples are arranged in order of the content of unsaturated hydrocarbons (olefines, etc.) as determined by contraction on treatment with fuming sulphuric acid.

SESSIONAL PAPER No. 14

PREMIER Brand

arranged in order of olefine content

Serial No.	Collector's No.	Spec. Grav. 15·5°	Fractionation.					Iodine No.	Polymerization olefine.	Volatile below 120°.	Volatile above 140°.	Loss.
			Below 70° C.	70° to 120°.	120° to 140°.	140° to 150°.	Above 150°.					
1	69538	0·721	11·0	70·0	11·0	2·5	4·5	8·5	2·2	81·0	7·0	1·0
2	69536	0·720	11·5	71·2	10·0	2·8	4·5	8·6	2·7	82 7	7·3	0·0
3	69531	0·720	12·5	70·2	10·5	1·8	4·0	8·7	2·8	82·7	5·8	1·0
4	69537	0·721	12·0	67·5	12·0	3·5	4·5	8·1	2 9	79·5	8·0	0·5
5	69539	0·720	11·0	71·7	10·8	2·0	4·0	8·8	3·4	82·7	6·0	0·5
6	69534	0·719	11·5	72·0	10·0	2·0	3·4	.....	3·5	83·5	5·4	1·1
7	69532	0·720	13·5	69·2	10·8	2·0	4·0	8·5	3·6	82 7	6·0	0·5
8	69540	0·721	9·5	73·0	11·5	0·0	5·0	9·0	3·7	82·5	5·0	1 0
9	68247	0·739	7·0	64·6	15·2	5·2	7·0	9·1	3·8	71·6	12·2	1·0
10	52508	0·744	6·0	58·5	17·5	7·0	10·6	12·2	4·7	64·5	17·6	0·4
11	52509	0·741	6·5	58·0	18·0	6·7	10·3	12·8	5·8	64·5	17·0	0·5
12	65007	0·743	3·5	49·5	18·0	7·5	21.2	28·2	6·9	53·0	28 7	0 3
13	B.	0·736	3·5	54·0	20·0	7·5	14·6	32·9	8·0	57·5	22·1	0·4
14	G.	0·738	3·7	51·3	20·8	7·4	15·5	32·4	8·4	55·0	22·9	1·3
15	I.	0·741	3·0	50·8	22·7	7·8	15·0	30·5	8·5	53·8	22·8	0·7
16	71602	0·732	6·5	54·0	20·3	6·7	11·2	35·0	8 8	60·5	17·9	1·3
17	A.	0·740	4·5	51·2	26·7	7·6	15·8	31·7	8·9	55·7	23·4	0·2
18	75458	0·732	10·5	46·0	20·0	7·0	16·0	33·4	9·3	56·5	23·0	0·5
19	75436	0·734	6·0	52·8	17·7	8·0	15·0	37·9	9 6	58·8	23·0	0·5
20	C.	0·733	6·5	52·0	20·0	7·5	13·0	38·6	10·2	58·5	20·5	1·0
21	65032	0·735	7·0	49·5	18·5	7·1	17·0	44·0	11·3	56·5	24·1	0·9

White Rose Brand.

1	75437	0·744	5·0	66·5	14·5	5·5	8·5	1·9	1·7	71·5	14·0	−0·0
2	68248	0·743	6·0	57·5	18·0	7·4	10.2	4·3	2·4	63·5	17·6	−0·9
3	R.	0·729	2·5	72·0	14·0	4·7	5·9	.....	2·6	74·5	10·6	−0·9
4	Q.	0·729	3·0	67·0	17·0	4·9	7·5	12·4	2·8	70·0	12·4	−0·6
5	71603	0·736	12·0	48·0	13·5	8·1	17·5	3·3	3·0	60 0	25·6	−0·9
6	69535	0·746	1·0	42·0	26·7	10·3	20·0	.....	3·6	43·0	30·3	−0·0
7	69533	0·743	2·0	45·5	22·0	9·5	20·0	.....	4·0	47·5	29·5	−1·0
8	52505	0·734	9·5	47·5	19·5	8·3	14·0	25·5	7·9	57·0	22·3	−1·2
9	H.	0·741	5·5	52·0	20·0	7·3	13·6	30·9	8·4	57·5	20·9	−2·1

Peerless Brand.

1	65006	0·730	3·5	59·5	15·5	6·5	13·5	4·8	1·5	63·0	20·0	−1·5
2	E.	0·720	10·5	67·0	9·7	3·3	6·7	1 3	2·0	77·5	10·0	−2·8
3	75461	0·737	3·5	54 0	20·0	9·3	13·2	7·7	2·1	57·5	22·5	−0·0
4	O.	0·732	12.8	18·2	16·5	12·0	36·8	.....	3·8	31·0	48·8	−3·7
5	F.	0·730	12·7	44·9	15·2	6·2	20·0	3·2	3 9	57·6	26·2	−1·0
6	65034	0·729	4·0	57·0	18·5	7·1	13·4	4·3	4·3	61·0	20·5	−0·0

British Motor Brand.

1	M.	0·720	11 5	58·0	13·5	6·5	10·5	.....	3·1	69·5	17 0	−0·0
2	N.	0·732	6·5	49·0	19·0	8·5	17·0	.....	3·5	55·5	25·5	−0·0
3	75459	0·735	5·5	47 0	21·5	8·5	16·7	20·8	5·6	52·5	25·2	−0 8

Premier Brand.—A user who had found satisfactory the first seven samples, which fairly resemble each other, would assuredly be disappointed with number 12 and succeeding samples, except perhaps number 18, which may contain enough of the component volatile at 70° to gaseify the heavy hydrocarbons, volatile only above 140°.

It will be noted that the specific gravity gives no certain indication of the composition of the article. While in a general way, a gravity not exceeding 0.720 indicates a large percentage boiling below 120° C. (in samples 1 to 8, about 80 per cent), the higher gravities, from 0·730 to 0·740, correspond to very irregular composition of the mixture. Thus, numbers 9·11 and A, which possess nearly the same gravity, contain respectively 71·6; 64·5 and 55.7 per cent boiling below 120° C.; 12.2; 17·0 and 23·4 per cent above 140° C.; of which 7·0; 10·3 and 15.8 is only volatile above 150° C.

White Rose Brand.—Much the same thing is indicated here. The fraction volatile below 70° C. varies from 1 to 12 per cent of the mixture; while the portion volatile above 150° C. runs from 5·9 to 20 per cent.

Peerless Brand.—Similar differences in character are found here. The portion volatile below 70° C. varies from 3·5 to 12·8 per cent, while that volatile above 150° C. varies from 6·7 to 36·8 per cent. It is certain that an adjustment of feed which would give satisfactory working with No. 2, would fail to give results with No. 4.

British Motor Brand.—This shows considerable differences between the samples; although the small number reported makes detailed comparison impossible.

Internal combustion engines, using gasoline, are employed under extremely varying conditions. For motor cars, where frequent stopping and starting is the rule, it is evident that a readily volatile gasoline is required; and particularly is this necessary in cold weather. Quite other conditions obtain in the case of stationery engines, working under cover. From these, and other considerations, it appears reasonable to expect that gasoline should be sold under a guarantee of specific character; and both manufacturer and consumer should understand the importance of recognizing well defined grades of the article. I learn (Metallurgical and Chemical Engineering, 1916, 557) that the Bureau of Mines, Washington has prepared tentative specifications in regard to gasoline, having special reference to the grading of this fuel. It is suggested that three classes be named, and defined according to the maximum temperature limit below which 90 to 95 per cent volume will distil. The specific gravity test is to be discarded as of no real value with mixed gasolenes. Other specifications require that the gasoline should not contain excessive percentages of unsaturated or aromatic hydrocarbons, nor too high a percentage of very volatile products, which cause danger and loss by evaporation; nor should any considerable amounts of heavy or non-volatile constituents be present.

The post office authorities of Chicago, as reported in the Chicago American (Oct. 1916) have fixed the following standards for gasoline for their use:

1. The boiling point must not be higher than 60° C.
2. Fifty per cent must distil below 135° C.
3. Ninety-five per cent below 177° C.
4. One hundred per cent below 191° C.
5. Not less than 95 per cent must be recovered by distillation: *i.e.* loss on distilling must not exceed 5 per cent.
6. Five cubic centimetres must evaporate from white paper without leaving a stain.

Holde (Translation by Mueller, 1915, p. 51) quotes the following specifications for Automobile Gasoline:—

1. Must be obtained by fractional distillation.
2. Must not leave a spot on white paper.
3. Running through a sieve should not separate into fine drops.

4. Of uniform composition, and, not a mixture of high and low boiling products.
5. Light naphtha should distil 80 per cent. under 100°C, and completely under 130°C.
6. Heavy naphtha, 50 per cent. under 100°C, and all under 140°C.
7. For passenger service the specific gravity should be from 0.70 to 0·72 at 15°C; for trucks, from 0·72 to 0·75.

It will, of course, be evident that authoritative classification of the 88 samples herein reported is impossible. This report will however serve the purpose of acquainting the public with the character of gasoline as found on Canadian markets.

TABLE I.

LIGHT GASOLINE

At least 10 per cent. distils below 70°C. Less than 10 per cent. residue above 150°C.
Samples are arranged in order of the distillate below 70°C.

Serial No.	Collector's No.	Where Obtained.	Spec Grav. 15°C.	Fractionation.					Iodine No.	Polymerization by Sulphuric Acid.	Loss.
				Below 70°.	70° to 120°.	120° to 140°.	140° to 150°.	Above 150°.			
1	75438	Hamilton	·700	28·5	54·0	8·2	0·0	9·0	2·4	2·4	0·3
2	69532	St. John, N.B.	·720	13·5	69·2	10·8	2·0	4·0	8·5	3·6	0·5
3	69531	" N.B.	·720	12·5	70·2	10·5	1·8	4·0	8·7	2·8	1·0
4	69537	Fairville, N.B.	·721	12·0	67·5	12·0	3·5	4·5	8·1	2·9	0 5
5	69534	St. John, N.B.	·719	11·5	72·0	10·0	2·0	3·4	....	3·5	1·1
6	69536	Gold Brook	·720	11·5	71·2	10·0	2·8	4·5	8·6	2·7	0·0
7	69538	St. John, N.B.	·721	11·0	70·0	11·0	2·5	4·5	8·5	2·2	1·0
8	69539	" N.B.	·720	11·0	71·7	10·8	2·0	4·0	8·8	3·4	0·5
9	E	Ottawa	·720	10·5	67·0	9·7	3·3	6·7	1·3	2·0	2·8
10	55670	Vancouver, B.C.	.....	10·1	64·9	12·5	5·1	6·0	0·5	1·6	1·4

Gasoline of this type will probably give no trouble to the user as far as starting the engine is concerned. It may be found dangerous in storage on account of its ready volatility, and it may show considerable loss in transport. It contains little, if any, of the cracked product.

TABLE II.

Gasoline containing large fractions volatile only above 150°C, but having more than 10 per cent. volatile below 70°C. Samples are arranged in order of the residue above 150°C.

Serial No.	Collector's No.	Where Obtained.	Spec. Gravity 15°C.	Fractionation.					Iodine No.	Polymerization by Sulphuric Acid.	Loss.	Percentage Volatile Below 140°C.
				Below 70°.	70° to 120°.	120° to 140°.	140° to 150°.	Above 150°.				
1	75462	Toronto	·738	12·5	18·1	13·2	7·7	48·0	9·2	3·4	0·5	43·8
2	O	Ottawa	·732	12·8	18·2	16·5	12·0	36·8	.....	3·8	3·7	47·5
3	75463	Toronto	·730	14·5	38 5	15·0	6·2	24·5	26·9	8·0	1·3	68·0
4	75432	Owen Sound	·720	17·5	40·0	13·0	6·1	22·5	.....	3·7	2·9	70·5
5	F	Trenton, Ont	·730	12·7	44·9	15·2	6·2	20·0	3·2	3·9	1·0	72·8
6	52507	Calgary	·732	15·0	40·0	15·5	8·0	19·0	4·2	2·0	2·5	70·5
7	71603	Indian Head, Sask	·736	12·0	48·0	13·0	8·1	17·5	3·3	3·0	1·4	73·0
8	75458	Toronto	·732	10·5	46·0	20·0	7·0	16·0	33·4	9·3	0·5	76·5
9	52504	Calgary	·730	10·5	53·0	17·4	3·6	15·5	2·8	1·4	0·0	81·9
10	52501	"	·731	12·0	50·0	17·5	6·5	13·5	2·4	2·8	0·5	79·5
11	71616	Wolseley, Sask	·724	15·0	55·5	10·3	4·7	12·9	4·2	2·0	1·6	80·8
12	M	Ottawa	·720	11·5	53·0	13·5	6 5	10·5	....	3·1	0·0	83·0

The whole of the gasolines of this series, but more particularly the earlier numbers, will give trouble in motor engines; the percentage volatile above 150° is great, and the amount of very light hydrocarbon is not great enough to assure complete volatilization of the high boiling fraction. Numbers 3 and 8 contain notable amounts of cracked gasoline. The high boiling residue is practically in inverse ratio to the total volatile below 140°C. It will be noted that numbers 1 and 2 are quite exceptional in this regard.

It is probable that samples giving Iodine numbers of 8 or higher contain cracked gasoline; and if the number is higher than 10 the indication is practically certain. (Technical paper 163, Bureau of Mines, Washington.)

TABLE III.

GASOLINES in which both the most volatile fraction (below 70°C.) and the least volatile fraction above 150°C.) are below 10 per cent arranged in order of total volatility below 140°C.

Serial No.	Collector's Number.	Where Obtained.	Spec. Gravity 15°C.	Fractionation.					Iodine Number.	Polymerization by Sulphuric Acid.	Loss.	Percentage Volatile Below 140°C.
				Below 70°.	70° to 120°.	120° to 140°.	140° to 150°.	Above 150°.				
1	69540	St. John, N.B	·721	9·5	73·0	11·5	0·0	5·0	9·0	3·7	1·0	94·0
2	63859	Sydney, N.S	·724	9·5	71·0	11·0	4·3	4·0	6·9	3·4	0 2	91·5
3	5456	St. Gabriel, Brandon	·728	7·0	69·5	12·5	4 0	5·9	7·8	2·2	1·1	89·0
4	5433	St. Jean Matha	726	8 5	69·5	10·8	5·0	5·0	8·9	2·6	1·2	88·8
5	R	Hamilton	·729	2·5	72·0	14·0	4·7	5·9	.....	2·6	0 9	88·5
6	55669	Vancouver	·742	8·8	66·7	13·0	4·5	6·5	0·6	3·9	0 5	88·5
7	55676	South Vancouver.....	·744	9 5	66·0	12·0	5·0	6·8	.... .	2·8	0·7	87·5
8	55678	Vancouver..... ..	·743	8·9	66·1	12·5	5·0	6 0	0·6	1·8	1·5	87·5
9	Q	Hamilton..	·729	3·0	67·0	17·0	4·9	7·5	2·8	2·0	0·6	87·0
10	68247	Nelson, B.C.....	·739	7·0	64·6	15·2	5·2	7·0	9·1	3·8	1·0	86·8
11	52503	Calgary.....	·732	9·5	63·0	14·0	4·5	8·5	9·8	4·5	0 5	86·5
12	52502	"	·732	9·0	64·7	12·8	5·0	8·5	9·5	2·9	0 0	86·5
13	5444	St. Gabriel, Brandon	·727	8·0	62 5	16·0	4·6	8·4	14·7	4·0	1 0	86·0
14	75437	Hamilton	·744	5·0	66 5	14 5	5·5	8·5	1·9	1·7	0·0	86·0
15	D	....	·724	5·0	63·5	17·0	5·5	8·0	.....	2·8	1·0	85 5
16	55680	New Westminster... . .	·742	5·5	62·0	18·0	5 7	8·5	15·2	4·1	0·3	85·5
17	55672	Vancouver	·741	5·0	63·5	17·0	5·5	8·5	8·3	3·8	0·5	85·5
18	5432	St. Felix de Valois	·729	6·8	66·1	11·7	6·4	8·8	14·5	4·4	0 2	84·6
19	71617	Wolseley, Sask.....	·735	3·7	61·8	18·5	5·8	8·5	30·6	7·4	1·7	84·0
20	55679	New Westminster.....	743	5·5	61·5	16·8	6·2	9·0	14·6	5·0	1·0	83·8
21	55675	Vancouver	·743	5·5	60·0	17·5	6·5	8·5	9·6	4·0	2·0	83·0

Gasolines of the type represented in this table, should be found satisfactory. They do not contain enough of the very volatile component to make them abnormally dangerous in storage; nor is the high-boiling residue excessive. Cracked gasoline if present in a few of them is in small amount.

TABLE IV.

FORTY-FIVE samples Gasoline not included in the preceding Tables; and having more than 10 per cent residue over 150°C., arranged in order of this residue.

Serial Number.	Collector's Number.	Where Obtained.	Spec. Gravity 15°C.	Fractionation.					Iodine Number.	Polymerization by Sulphuric Acid	Loss.	Percentage Volatile Below 140°.
				Below 70°.	70° to 120°.	120° to 140°.	140° to 150°.	Above 150°.				
1	75445	Niagara Falls	·746	5·0	46 0	17·8	7·7	23·0	38·5	10·4	0·5	68·8
2	65007	Exeter, Ont.	·743	3·5	49·5	18·0	7·5	21·2	28·2	6·9	0·3	71·0
3	69533	St. John, N.B.	·743	2·0	45·5	22·0	9·5	20·0	. . .	4·0	1·0	69·5
4	69535	"	·746	1 0	42·0	26·7	10 3	20·0	. .	3·6	0·0	69·7
5	75466	Toronto	740	5·5	45 5	20·5	8·0	20·0	12·8	4·3	0·5	71·5
6	L	Ottawa..	·738	5·0	47·2	19·3	8·0	19·7	36 1	8·8	0 8	71·5
7	63860	Sydney, N.S	·743	2·0	45·5	24·0	10·0	18·5	4·6	2·5	0·0	71·5
8	P	Ottawa	·737	6·7	51·8	15·0	7·4	17·5	47·4	11·5	1·6	73·5
9	75460	Toronto	·736	6·0	46·5	21·3	8·9	17·0	15·2	4·4	0·3	73 8
10	65032	London, Ont.	·735	7·0	49·5	18·5	7 1	17·0	44·0	11·3	0·9	75·0
11	N	Ottawa	·732	6·5	49 0	19·0	8·5	17·0	.	3·5	1·0	73·5
12	75459	Toronto	·735	5·5	47·0	21·5	8·5	16·7	20·8	5·6	0·8	74·0
13	A	Hamilton.	·740	4·5	51·2	20 7	7 6	15·8	31·7	8·9	0·2	76·4
14	G	Kingston	·738	3·7	51·3	20·8	7·4	15·5	32·4	8·4	1·3	75·8
15	65037	London, Ont	·729	4·0	59·0	15·5	6·0	15·0	4·2	4·8	0·5	78·5
16	75433	Wiarton, Ont	·743	1·5	49·3	24 9	9·2	15·0	...	3·6	0·1	75·7
17	75435	Brantford	·733	8·5	50·0	19·0	7·0	15·0	51·5	12·2	0 5	77·5
18	75436	"	734	6·0	52 8	17·7	8·0	15·0	37·9	9 6	0·5	76·5
19	I	Kingston	·741	3 0	50 8	22·7	7·8	15 0	30·5	8·5	0·7	76·5
20	J	"	·739	3·8	51 9	19·8	9·0	15·0	32·7	8·0	0·5	75·5
21	B	Port Hope	·736	3·5	54 0	20·0	7·5	14·6	32·9	8·0	0·4	77·5
22	52505	Calgary	·734	9·5	47·5	19·5	8·3	14·0	25·5	7·9	1·2	76·5
23	H	Hamilton.	·741	5·5	52·0	20·0	7·3	13·6	30·9	8·4	1·6	77·5
24	K	"	·737	4·5	52·5	21·5	7·3	13·5	28·4	9·6	0·7	78·5
25	6500	Exeter, Ont.	·730	3·5	59·5	15·5	6·5	13·5	4·8	1·5	1·5	78·5
26	65038	London.	....	5·0	57·0	15·0	7·5	13·5	..	.....	2·0	77·0
27	65034	"	·729	4·0	57·0	18·5	7·1	13·4	4·3	4·3	0·0	79·5
28	75461	Toronto	·737	3·5	54·0	20·0	9·3	13·2	7·7	2·1	0·0	77·5
29	C	Ottawa.	·733	6·5	52·0	20·0	7·5	13·0	38·6	10 2	1·0	78·5
30	5441	Joliette.	·734	4·5	53·0	20·5	8·0	12·5	30·9	8·2	1·5	78·0
31	75464	Toronto	·731	7·0	52·5	20·5	7·0	12·5	41·7	10·5	0·5	80·0
32	75465	"	·729	5·0	55·7	19·3	8 0	12·0	4·8	3·9	0·0	80·0
33	5447	Joliette	·734	4·5	54·0	21·0	8·0	12·0	31 5	8·5	0·5	79·5
34	71610	Grenfell	·733	4·5	56·5	19·0	7·2	11·5	35·2	9·5	1·3	80·0
35	5426	Joliette	·735	4·0	55·0	20·5	7·5	11·3	30·9	8·2	1·2	80·0
36	71602	Indian Head	·732	6·5	54·0	20·3	6·7	11·2	35·0	8·8	1·3	80·8
37	55677	So. Vancouver	·745	8·0	56·5	17·5	6 6	11·0	3·3	4·0	0·4	82·0
38	5425	Joliette.	·737	4·5	55 5	20·7	6·8	11·0	33·9	9·4	1·5	80·7
39	55668	Vancouver	·745	6·0	57·5	18·3	7·3	10·8	....	4·4	0·1	81·8
40	52508	Calgary	·744	6·0	58·5	17·5	7·0	10·6	12·2	4·7	0·4	82·0
41	52506	"	·739	6·0	62 0	15·0	6·5	10·5	11·6	3 0	0·0	83·0
42	52509	"	·741	6 5	58 0	18·0	6·7	10·3	12·8	5·8	0 5	82·5
43	68248	Nelson, B.C.	·743	6·0	57·5	18·0	7·4	10·2	4 3	2·4	0·9	81 5
44	52511	Calgary	·743	5·0	58·5	19·0	6 5	10 2	16·1	5·2	0·8	82·5
45	75431	Owen Sound	·730	7·0	55·0	23·0	4·5	10 0	29·7	8·0	0 5	85·0

With a few exceptions at the extremes of this table, the gasolines which it includes, show notable uniformity so far as the percentage distilling below 140°C. is concerned; and this in spite of the fact that the amount of cracked gasoline in them is extremely variable. This is indicated by the large iodine number and the contraction on polymerization, which, in a general way, approximates one fourth of the iodine number. While it is apparent that most of these samples contain more or less cracked gasoline, those designated P, 65032, 75435, C, and 75464, contain very large amounts. The mixing has, however, been done with judgment; and a machine adjusted so as to

work well with almost any one of these samples would probably work satisfactorily with any other.

It would seem useless to object to the presence of cracked gasolines, since the demand for gasoline is so great, that, straight distillates from the crude, would entirely fail to meet it, and the cracking of heavier hydrocarbons is imperative.

The main features of the present report may be summarized as follows:—

1. The term gasoline has, at the present time, a quite different signification from that which it originally possessed.
2. When the most important application of petroleums was in domestic lighting, it was necessary to legislate to protect the consumer of coal oil. The reverse is the case to-day, and the user of gasoline requires protection.
3. Gasoline should not contain too volatile constituents, which make it dangerous in use, and entail loss in transportation.
4. Neither should it contain too great a percentage of difficulty volatile fractions, which seriously affect its use in motor engines.
5. Since most modern gasolines are mixtures, the specific gravity of the article affords no satisfactory indication of its character.
6. Various types of gasoline should be recognized and defined; since internal combustion engines are employed under widely varying conditions.
7. The brand name under which gasoline is sold in Canada is no guarantee of uniformity of character.
8. Cracked gasoline and Casing head gasoline, are not necessarily objectionable as components of mixed gasoline; but the mixed article should be made to conform to definite and well understood specification, and should be sold in such a way as to inform the buyer as to its character.
9. Gasoline should always be purchased to specification.

I believe that the report now in your hands will be useful in assisting the Department to regulate the sale of gasoline; and that it will afford users of the article, information which will be helpful to them; and enable them better to understand why ground for complaint is so widely apparent.

BULLETIN No. 363.—MALT EXTRACT FOR BAKERS' USE.

OTTAWA, 9th February, 1917.

SIR,—I had the honour, in February of last year, to report to you upon a collection of so-called Malt Extracts (152 samples) since published as Bulletin No. 326.

This term was found to include many different types of food material, varying from the pharmacopoeal article, to extracts which differed little, if at all, from ordinary beer.

Since publication of the report named, many inquiries have been made regarding the Malt Extracts which are now largely employed by bakers, and which were not specially represented in my last report.

The article in question is generally understood to be a concentrated preparation of the soluble matters of barley malt, so treated as not to destroy the activity of the diastase, whose presence and amount constitutes, probably, the most valuable feature of the extract from the baker's standpoint.

The diastatic value of Malt, and Malt Extract is usually expressed in degrees Lintner; and I have used this form of stating it, as being most intelligible to ordinary

readers. A malt preparation is said to have a value of 100 degrees Lintner, when one-tenth cubic centimeter of a 5 per cent solution converts enough starch to completely reduce 5cc of a standard Fehling's Solution, certain definite conditions of time and temperature being observed.

The Malt Extract of the British pharmacopoeia, as reported in Bulletin No. 326, was found to possess Lintner values somewhat above 100 degrees in the best samples, average samples giving values from 50 to 60 degrees.

Malt.—According to Ebertz and Schule (Lunge, Technical Methods, Vol. 111, 698) the diastatic power of English brewing malt is usually between 20° to 40° Lintner, while that of green malt may be as high as 100° to 125°.

Five of the samples purchased by our inspectors, are found to be, not malt extracts, as called for by their instructions, but ground malt, or malt flour. These five samples possess diastatic values ranging from 54·4 degrees Lintner to 64·5 degrees. (*See* samples 74813, 74814, 74815, 74818 and 75029.)

Malt Extract.

Baker (Allen's Commercial Organic Analysis, 4th Edn., Vol. 1, 145) quotes six samples of commercial extracts as giving Lintner values from 25·6 degrees, to 46·5 degrees; the mean value being 33·6 degrees.

Parry (Food and Drugs, 1911, page 166) quotes six samples of Malt Extracts, as varying from 14° Lintner to 38°; and mentions the last as being "one of the best known brands, and of the best quality." The mean value for these six samples is 26·7 degrees Lintner.

Eighteen samples herein reported vary from 12·2 degrees Lintner to 50·0 degrees, the average value being 30·0 degrees.

The content in reducing sugars, which represent complete hydrolysis of starchy matter, is also a condition of value. These substances not only give sweetness to the bread, but also assist in retaining the natural moisture of the loaf. According to Parry (loc. cit.) the reducing sugars, stated as maltose, in nine samples, varied from 48 per cent to 62 per cent, the average amount being 56·7 per cent.

Eighteen samples reported herein give reducing sugars (as maltose) from 60 to 75 per cent, averaging 67·9 per cent.

The ash of malt and malt extracts, represents the mineral constituents of the article; and this mineral matter possesses a value as yeast food.

There is no evidence in the accompanying analytical results, to show that additions have been made to the extracts for the purpose of increasing such yeast food. The ash normal to malt extracts, varies from about 1·4 to about 1·7 as a percentage on the extract. The ash found only exceeds these limits by being less in amount than the minimum quoted.

This is the first occasion upon which we have examined the special extract which forms the subject of this report; and I am not aware of any standards for the article having authoritative endorsement. If it should be considered desirable to fix such standards, a much fuller, and more extended investigation should be undertaken.

SESSIONAL PAPER No. 14

BULLETIN No. 364.—MALT VINEGAR.

OTTAWA, February 13, 1917.

SIR,—I beg to hand you a report concerning 185 samples of Vinegar, the great majority of which were sold as Malt Vinegars.

The report consists of two parts. The first part (twenty-two samples) represents a special collection made in Vancouver and Victoria, in February, March and April of last year. This collection was made consequent upon specific complaint (see L-138566) to the effect that vinegar was being offered in British Columbia, as Malt Vinegar, which was in reality not Malt Vinegar, but a fraudulent imitation of the article. An examination of this report proves conclusively that the complaint was well founded, only 11 of the 22 samples being genuine.

Further investigation, however, showed that in several instances, the apparent fraud was due to incorrect reading of our standards for Vinegar, as published in G. 1096, dated December 29, 1913. The standards referred to provide for the sale of Blended Vinegar, which is defined as a mixture of two or more varieties of Vinegar. Most of the samples found to be illegal, were labelled in a manner to indicate that they were blended; but while the amount of Malt Vinegar in the blend was very small, the words Malt Vinegar were most conspicuous on the label, with the result of deceiving the purchaser into the belief that he was buying a genuine Malt Vinegar or at least an article which contained a large proportion of Malt Vinegar.

Since a comprehensive inspection of the article was proposed for June, July and August of 1916, it was considered reasonable to permit the offence, as above described, to be passed over with a formal warning.

The remainder of this report deals with 163 samples purchased in June, July and August of last year. Inspectors were carefully instructed to purchase Malt Vinegar only; and in most instances this instruction was observed. In the case of Mr. Inspector Audet, five samples (5353, 5356, 5359, 5361 and 5364) are invoiced simply as Vinegars. None of these samples are Malt Vinegars, and if sold as such, are adulterated under the Act. Mr. Inspector Audet has since explained (see his letter of March 1, 1917), that he demanded malt vinegar in every instance.

The subjoined synopsis gives the general results of this examination.

COLLECTION OF FEBRUARY, MARCH AND APRIL, 1916.

Found genuine Malt Vinegars	11	samples.
Found not to be Malt Vinegars, but sold under names which implied Malt Vinegar either entirely or as a blend	11	"
	22	"

COLLECTION OF JUNE TO AUGUST, 1916.

Found genuine Malt Vinegars	97	samples.
" adulterated under the Act	31	"
" slightly below standard and passed	35	"

Standards for Vinegar have been legalized since December 19, 1913; and Circular G. 1096 embodying these standards was published on December 29, 1913. Bulletin No. 313, which contains a detailed report of two hundred and forty-five samples of Vinegar, was published in May, 1915. I mention these facts to justify the conclusion that vendors of the article have been fully warned in the matter, and cannot

reasonably urge any excuse for selling as Malt Vinegar an article which does not comply with legal requirements.

The characteristic constants of Malt Vinegar comprise a minimum content of solids (1·80 per cent) and a minimum content of mineral solids, or ash (0·20 per cent). Phosphates are characteristic of the ash of Malt Vinegar; and it will be found on examination of this report, that the amount of phosphoric acid is seldom less than about 40 to 50 milligrammes per 100cc. of Vinegar. In many cases it reaches a much higher number. Spirit Vinegar, on the other hand, contains but little ash, and the phosphoric acid content is trifling, or nil.

A considerable number of samples yield results which prove conclusively that malt has been employed in their manufacture. This industry is a new one in Canada, and it is fair to assume that failure to produce a perfectly satisfactory malt vinegar is rather due to inexperience than to any desire to put out a surrogate article. Being convinced of the essential truth of this assumption, I have ventured to pass all samples which give evidence of having been made from malt, even although such samples fail to reach the standard of a normal malt vinegar; and I would respectfully ask you to justify my interpretation, for this occasion. Of course it must be understood that such concession can form no precedent for future decisions; and that it is granted in recognition of the fact that honest efforts are being made by Canadian manufacturers to produce a malt vinegar which shall fully meet legal requirements.

When Acetic Acid is employed in the manufacture or fortification of a Vinegar, traces of formic acid are almost invariably found in a distillate from such Vinegar. Mr. Rowat, of this staff, has done a considerable amount of research work, at my request, for the purpose of establishing the following points:—

1. Do genuine Malt Vinegars yield a distillate which could be mistaken to contain formic acid?

2. If a genuine Malt Vinegar, not responding to the test for formic acid, be fortified by addition of commercial, refined acetic acid, will it then give the formic acid reaction?

3. If it does so, is the intensity of the reaction proportional to the amount of acetic acid added?

Mr. Rowat's work clearly shows that genuine Malt Vinegars give no reaction for formic acid when treated by the method of Woodman and Burwell (Allen, Com. Org. Analysis, 4th Edn. Vol. 1, page 521); that addition of commercial acetic acid, containing traces of formic acid, is readily detected; and that the depth of colour with fuchsin, is approximately proportional to the amount of acetic acid added.

BULLETIN No. 365—CARAMELS.

OTTAWA, March 12, 1917.

SIR,—In Bulletin No. 346 (published in July of last year) I drew attention to the alleged extensive employment of paraffin as a stiffener in the form of candy sold as Chocolates. Seven samples of the 151 samples therein reported were found to contain paraffin; but the amount was not determined.

Concerning paraffin as a component of a food product I made the following statement:—

"The National Confectioners' Association of the United States, issued a Food Law Circular under date May 20, 1913, containing a list of substances prohibited in confectionery, among which appears paraffin.

The food laws of Illinois, Nebraska and Utah, specifically forbid the use of paraffin in candy; and those of many other States are interpreted in such a way as to condemn its use.

It is certain that so-called paraffin or paraffin wax is wholly without food value; is quite indigestible, and is not a normal component of any natural food material. Its melting point (about 54·5°C. = 130·1° Fah.)is so high as to keep it solid at the body temperature, and being quite insoluble in the digestive fluids, it is conceivable that serious results might ensue from its presence in foods consequent upon mechanical disturbances."

Several correspondents have claimed that, while paraffin is occasionally employed by manufacturers of the cheaper grades of so-called Chocolates, it is much more largely used in that form of confection known as Caramels.

It was considered desirable to ascertain the facts of the case, and in consequence a collection of caramels was ordered in October and November of last year.

This report, dealing with 110 samples may be summarized as follows:—

Caramels containing no paraffin..	30	samples.
" " traces only..	8	"
" " less than 0·5 per cent..	8	"
" " more than 0·5 per cent but less than 1·0 per cent....	13	"
" " more than 1 per cent..	51	"
Total..	110	

Of 51 samples which contain above 1 per cent by weight of paraffin, the subjoined table gives particulars:—

From 1 to 2 per cent paraffin..	23	samples.
" 2 " 3 " "	12	"
" 3 " 4 " "	10	"
" 4 " 5 " "	5	"
" 5 " 6 " "	0	"
" 6 " 7 " "	1	"
Total..	51	

We have no direct legislation against the use of paraffin in candy. Whether or not the amounts above indicated can be regarded as harmful to health is a matter for very careful consideration, and will be duly investigated.

Since writing the above I have received the following expression of opinion from Dr. A. D. Blackader, Professor of Pharmacology at McGill College, Montreal, and Medical Adviser to this Department.

"It is a subject to which my attention had never been previously drawn, and I have taken time to consult my confrères and made enquiries from all whom I thought might give me an opinion. The answer I received from most of my confrères was to the effect that in amount so small as 1 per cent it was not likely to do any harm, one might even say 2 per cent, but that in larger amounts there was a possible risk in persons or children who consumed large amounts of candy.

In his very recent volume on Pharmacology (1916) Sollman states that pure paraffin is harmless, ill-refined paraffin may give rise to toxic symptoms. Any impurity in the paraffin used for caramels may do harm in several ways. Care therefore must be taken that only pure paraffin is employed. If the paraffin is pure, and in amount does not exceed 1 per cent I do not think its employment can do harm. The only objections to it is that it is of no use as a food, and in candy may be regarded as an adulteration."

BULLETIN No. 366—CANNED PEAS.

OTTAWA, March 16, 1917.

SIR,—I beg to hand you a report upon 210 samples of canned peas. All of these samples prove to be of good quality so far as the vegetable matter is concerned.

The special object had in view in this collection was the ascertaining whether or not departmental regulations as regards the presence of copper in peas were being observed.

Our last systematic inspection of peas, was made in 1909, and is published as Bulletin No. 192. No regulations in the matter of copper colouring existed at that time; and it was particularly desired to ascertain whether or not the presence of such amounts of copper as experience has shown sufficient to give a desired colour to peas, was attended with danger to the health of the consumer.

I recommended that the subject should be referred to competent medical authorities; and as the result of such action, the following decision was reached, and is incorporated in an Order in Council of January 9, 1915, published as G. 1167.

"III. In all cases except such as are covered by sections I and II above, the presence of artificial colouring matter must be declared upon the label, in easily legible type.

IV. When used in the amounts necessary to produce desirable colours in foods, the following substances are regarded in the light of present knowledge of their physiological effects, as harmless to health, within the meaning of the Adulteration Act. Should more extended knowledge of the effects upon the health of any of the colouring matters named below establish their harmfulness, they would, in such case, come under section 3 (*f*) of the Adulteration Act; and their presence in foods would constitute adulteration:—

Copper salts, in the greening of peas, provided that the amount of copper (expressed as metallic copper) in the peas does not exceed 80 parts (by weight) per million in the drained peas or 10 parts per million in the imbedding liquid."

The inspection now reported shows that only 26 samples out of a total of 210 samples are coloured with copper. These are, as far as can be ascertained, all imported peas. It is satisfactory to know that the demand for coppered peas is not largely in evidence in Canada; and that the colouring of peas with copper is not known to Canadian industry.

The conditions under which copper is permitted as a colouring material in peas, require (1) That the copper in the peas shall not exceed 80 parts per million. (2) That the copper in the imbedding liquid shall not exceed 10 parts per million. (3) That declaration of the presence of copper shall be made on the label.

Our work shows that no noteworthy excess of copper in the peas themselves occurs in any of these samples.

Excess of copper in the imbedding liquid is found in five samples. The amount varies from 20 to 73 parts per million.

The presence of copper is declared in three samples. Twenty-three samples contain copper without mention of this fact on the label.

SESSIONAL PAPER No. 14

BULLETIN No. 367—EDIBLE GELATIN.

OTTAWA, 22nd March, 1917.

SIR,—I have the honour to report upon 137 samples of Gelatin, purchased by our inspectors in April, May and June of last year.

The report is arranged in three parts. Table 1 furnishes the ordinary analytical results upon 57 samples. Table II gives results in greater detail upon 52 samples, specially examined by Mr. M. Brot of this staff now at the front, somewhere in France. Table III gives results for sulphurous acid only, in 28 samples of so called Jelly Powders. These articles are not properly described as Gelatin, although they contain gelatin as an ingredient.

Both edible gelatin and glue are obtained by treating the collagens of bones, tendons, cartilage, etc. with boiling water. It will be readily understood that, fundamentally, they are the same thing. The essential character of edible gelatin, as distinguished from glue, is its purity. Glue may be a perfectly pure article without ceasing to be glue; but edible gelatin must be a pure article; and, in order to ensure a satisfactory degree of purity, it should be required to meet certain specified standards.

The treatment which the original material receives in the manufacture of gelatin is such as to fairly well assure the destruction of organic impurity. But when we consider the nature of the material available for the manufacture of glue, dead animals of all kinds, and in various stages of decomposition, we must recognize the desirability of giving the consumer of gelatin a guarantee that only selected and unobjectionable materials have been used in its production. This can only be done by efficient inspection at the factory; and for this reason, the inspection of all gelatin factories should be undertaken by Government. So far as Canada is concerned, this is the case; and the Department of Agriculture, in its administration of the Meat Inspection Act, guarantees the quality of the material used in manufacture of edible gelatin, so far as meat packers, doing an export business is concerned. I am not however aware that the manufacture of gelatin is anywhere in Canada carried on beyond the actual requirements of the manufacturer in his own business. Practically all of the gelatin used in Jelly Powder manufacture, in ice-cream, etc. is of foreign manufacture.

The Department of Customs has kindly furnished me with the following statistics concerning the importation of gelatin and isinglass (fish gelatin) for the fiscal year ending 31st March, 1916.

	Lbs.	Value.
United Kingdom	179,173	$43,327
China	41	8
France	13,112	2,507
Holland	2,231	460
Japan	10,280	3,570
Switzerland	13,862	2,684
United States	246,116	91,035
Total	464,815	$145,591

Gelatin is thus defined by the British Phramacopœia, revision of 1914; "Is the air-dried product obtained by the action of boiling water on animal tissues, such as skin, tendons, ligaments and bones.

Characters and Tests.—In almost colourless, translucent sheets or shreds. Insoluble in alcohol (90 per cent) and in ether: soluble in acetic acid. A solution in hot water (1 in 50) is inodorous, and solidifies to a jelly on cooling. An aqueous solution yields a precipitate with solution of tannic acid, but not with solutions of other acids, or with dilute solution of alum, solution of lead acetate, or test solution of ferric chloride. Ash not more than 2 per cent."

Gelatin finds extensive uses in the arts, and most of its applications require the article to possess a high degree of purity. The definition above quoted has primary regard to its employment in medicine, where it is used in the manufacture of capsules and otherwise. It is, however, with its use as a food material that we are immediately concerned.

As a food, gelatin enters into the manufacture of so-called jelly powders, in jellied meats, as a stiffener in ice cream, etc.

Investigatory work, having for its object the fixing of definite distinction between edible gelatin and glue, as used in the arts, has for a considerable time been carried on by the Department of Agriculture at Washington. I am not informed of the completion of the work referred to, but by correspondence I learn that the most important characters considered to establish the distinction are odour, turbidity, jelly strength, fat and ash.

Colour is of necessity, a matter of importance, although the bright colours given by coal-tar dyes to most jelly powders, reduce its importance so far as these are concerned. Where select materials are employed in the manufacture, it should not be necessary to use bleaching agents to give edible gelatin desirable lightness of colour. Our standards require that sulphur dioxide (sulphurous acid) shall not be present in solid foods above 1 part in 2,000 parts (50 parts per 100,000). This limit is exceeded in 11 samples of Table I and in 10 samples of Table II.

Traces only of sulphurous acid are found in the jelly powders enumerated in Table III.

Ash.—The British Pharmacopœia fixes 2 per cent, as the ash limit in gelatin. This limit is exceeded in 27 samples of Table I, and in 10 samples of Table II.

Odour.—This is observed by soaking in cold water for 4 hours and then making into a jelly by heating with water. Good samples yield no offensive odour. Thirteen samples of Table I and 14 samples of Table II gave more or less unpleasant odour when thus treated. Of this number 5 samples were decidedly objectionable, and should undoubtedly be classed as glue.

Turbidity of a 25 per cent, solution was observed in the samples arranged in Table II. Of the total number (52 samples) 15 samples gave more or less distinct turbidity; in 9 of them the turbidity was very marked.

Viscosity.—This may be determined by the method of flow, which however we have found to be very unsatisfactory and subject to large experimental error. Determinations as recorded in Table II were made on 25 per cent, solutions at 80° C. In a general way the results corroborated those ascertained by the use of the Doolittle Viscosimeter, but these last are much more trustworthy and duplicates in close agreement are easily obtained.

The instrument is standardized in terms of sugar solutions made as per instructions accompanying it.

We have not yet been able to formulate specific standards for gelatin, but it is hoped that this may be done in the near future, and the information furnished herewith will be helpful to this end.

SESSIONAL PAPER No. 14

BULLETIN No. 368—KETCHUP.

OTTAWA, 31st March, 1917.

SIR,—I beg to hand you a report upon 111 samples purchased as Ketchup (Catsup) by our inspectors in October and November of last year. With a single exception these represent Tomato Ketchup.

Four of these samples were found to be more or less fermented. Of this number, only one sample contained a preservative (benzoic acid) and this was present in mere trace. All the other samples were in good condition.

Fifty-five (55) samples contain a preservative; salicylic acid in two cases; in all the others, benzoic acid.

An Order in Council of 4th April, 1914 permits the use of benzoic acid to the amount of 1 part per 1,000 parts; and of salicylic acid, to the amount of 1 part in 5,000, under the following conditions:

"Provided that not more than one kind of preservative substance, named in this list, shall be added to any one kind of food, or to any mixture of two or more kinds of food; that the amount of preservative shall not exceed the maximum amount herein named, and that the presence of the preservative shall be declared on the label." (Circular G. 1111.)

Twenty-four (24) samples contain a dye (coal tar dye). This is permitted by Order in Council of 9th January, 1915, provided that only those dyes specially named in Circular G. 1167, may be used, and that the presence of the dye is declared upon the label, in clearly legible type.

No illegal dyes have been found in any of these samples; and preservatives are in all cases but three, within the legal limit. Benzoic acid is present to the amount of 1·8 parts per 1,000 in No. 76332; and to the amount of 1·3 parts per 1,000 in No. 73245. These quantities are probably harmless, in an article like Ketchup, which is employed as a condiment only. Sample No. 56835 contains salicylic acid to the amount of 2·6 parts per 1,000; and as the limit for salicylic acid is only 0·2 per 1,000, this represent a very large excess.

Many of these samples which contain either or both preservative and dye, make declaration of the fact upon the label. In 29 cases, however, there is failure to declare the presence of preservative or dye, or both, as required by the Orders in Council above cited. This, of course, constitutes a violation of th Act, and makes the vendor, or manufacturer liable of penalty.

In extenuation, it is claimed that many of these samples were on the market either before or very shortly after publication of our standards, and are, without any intention of violating the Act, labelled in the same way as was customary before standards regulating the use of preservatives and dyes were established. The standards in question are dated, April 1914 and January 1915 respectively. Purchase of these samples was made about the end of 1916, or about two years after legalization of standards.

There would appear, therefore, to be no validity in the claim made by manufacturers to be held exempt from penalty; but, since nothing that can be regarded as endangering public health can be urged against any of these articles, (with the single exception of No. 56835-. I would respectfully suggest that this report, so far as it affects the declaration of preservatives and dyes on the label, be regarded as a warning

to manufacturers of Ketchup that they will, in the future, be strictly held to the terms of our standards as published in G. 1111 and G. 1167.

It will further be noted that these samples vary greatly in the amount of solid material which they contain.

There can be no doubt that, as regards cost of manufacture and value to the consumer, they possess unequal values. A discussion of this phase of the matter will be found in the introduction to Bulletin No. 275 (February 1914) our last report on Ketchup.

I am not prepared however, to discuss this aspect of the question. Ketchup is a condiment, rather than a food proper, and it may be that the kind and quality of the material entering into its manufacture are of more importance than the quantity of such material. The consideration of this subject may be postponed for the present.